

Chapter 1 - Introduction

1.1 Study Purpose

Utah faces the complex issue of maintaining the capacity and the condition of its transportation infrastructure with limited funding, while travel demand and population continue to increase. Through this study, the Utah Department of Transportation (UDOT) is exploring the potential of managed lanes as another tool to alleviate Utah's current and future traffic demand.

This study addresses the many issues associated with these concepts, both technically and from an institutional perspective as they relate to Utah. For example:

- What are the benefits and costs of managed lanes?
- How much congestion will be reduced, if any?
- What criteria should be used in making decisions about managed lanes strategies?
- Will a project cost more or less with managed lanes strategies?
- Can managed lanes be part of a funding solution?

This study explores managed lanes options in use in the United States and around the world, and documents what works well and under what conditions. Finally, it identifies potential corridors where managed lanes (one or more strategies) are feasible on the state road system. Decisions of whether to implement a managed lanes strategy in a particular corridor will be determined during the normal environmental and project development level processes.

1.2 Managed Lanes Definition

Managed lanes are transportation strategies that can reduce congestion on the existing system or generate revenue to add capacity to the system. These strategies include:

- Reversible lanes
- High-Occupancy Vehicle (HOV) lanes (currently in use on I-15 in Salt Lake and Utah Counties)
- High-Occupancy Toll (HOT) lanes
- Toll roads
- Cordon pricing



HOV lanes is a managed lanes strategy currently in use in Utah

These concepts are discussed in detail in Chapters 3 and 4.

1.3 Goals & Objectives

The goal of this study is to provide relevant information about managed lanes and their potential in Utah. The study's objectives are to explore the role of managed lanes as a solution to statewide congestion problems, and to identify where proposed strategies are likely to work in terms of overall corridor performance costs and benefits.

This study supports UDOT's four strategic goals, which are:

- Take care of what we have
- Improve safety
- Make it work better
- Increase capacity



1.4 Project Team

The project team's responsibilities included assisting the development of the study by attending progress meetings and providing direct feedback to the results and recommendations presented at each meeting. The team members took the information from the study back to their respective "constituents" and in turn provided guidance to the direction of the study.

In addition, each team member had a specific role. The roles of team members were as follows:

- Region Director - discussed the study with the other Region Directors
- Director of Community Affairs - discussed the study with the Department leadership at headquarters
- Director of Legislative Affairs - discussed with legal counsel and select legislative representatives
- Project Development representative - shared information with key Project Development leadership

Chapter 2 - Managed Lanes Strategies

2.1 Managed Lanes Overview

This chapter provides an overview of the following managed lanes strategies:

- Reversible lanes
- High-Occupancy Vehicle (HOV) lanes
- High-Occupancy Toll (HOT) lanes
- Toll roads
- Cordon pricing

A description of each strategy is provided in the following sections.

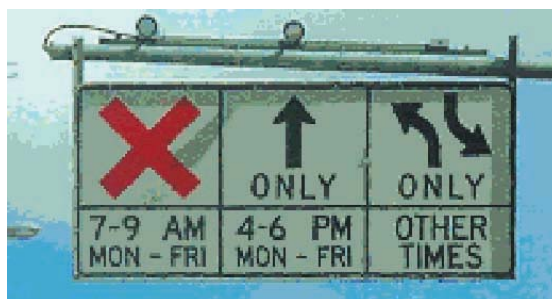
2.2 Reversible Lanes

Description - The center lane(s) of a road are operated in one direction for certain hours of the day and in the reverse direction for other hours. There are five different ways to implement reversible lanes, with varying degrees of vehicle separation.



Reversible Lanes
change direction
with peak traffic
flow

- **Signage** - Overhead signs inform drivers of the permissible reversible lanes direction at different hours. There is no physical separation between vehicles traveling in different directions. This is the least costly type of installation; however, it has the highest risk of head-on collisions.



Reversible Lanes
Grant Road Tucson,
Arizona

- **Cones** - Orange traffic cones are used to delineate the directions of travel. Drivers quickly recognize this type of temporary lane management, which is commonly used for work zones, and so are less likely to stray into the wrong lane than with signage alone. However, it does not provide a positive barrier to vehicles crossing into the wrong direction by accident. This type of installation requires crews to set up and take down the cones on a daily basis. Kapiolani Boulevard (Honolulu) is an example of this system.
- **Tubes** - This type of installation is similar to cones, except that bright yellow reflective plastic tubes are put into sockets drilled into the pavement. In some cases, the tubes are placed by hand (the Golden Gate Bridge in San Francisco, for example), while in other cases (the initial configuration of the Coronado Bridge in San Diego) the tubes are retractable and raised or lowered automatically. The sockets ensure that the tubes will be in exactly the same place every day and will not be moved by wind.



HOV lanes
are generally
reserved for
vehicles with
more than one
passenger

**Barrier Separated
HOV Lanes**
reduce violations
and allow for
higher speeds

- **Moveable Barriers** – Linked concrete barriers strong enough to deflect vehicles can be used to separate the directions of travel. A special vehicle shifts the barrier up to two lane-widths in either direction to reverse the direction of the lane. This system provides a positive barrier that prevents vehicles from straying into the wrong lane, and is suitable for high-speed facilities. In several cases (Coronado Bridge and Tappan Zee Bridge) the moveable barriers have entirely eliminated crossover accidents.
- **Permanent Barriers with Gates** – In some cases, usually freeways or tunnels, concrete barriers are permanently installed to separate the center lanes from either direction of travel. Entry into the center lanes is controlled by automatic gates, which are open for one direction of travel in the morning and the opposite direction in the evening. The Lincoln Tunnel (New York City) and the Katy Freeway (Houston) have examples of permanent barriers.

Functional Class – Reversible lanes work with freeways and arterials with three or more lanes.

2.3 High Occupancy Vehicle (HOV) Lanes



Description – Certain lanes in a multi-lane facility are reserved for the use of vehicles with more than one passenger. In most cases, (70 percent of facilities in the United States) vehicles with two or more occupants can use the HOV lanes. Other HOV facilities (30 percent of facilities in the United States) require three or even four occupants. There are several types of HOV facilities in use.



- **Concurrent Flow, Non-Barrier Separated** – The most common configuration is for the median lane of a freeway to be marked with a diamond and have HOV signage. Without barrier separation from the general purpose lanes, this technique allows for continuous entry and exit. This configuration is the most convenient for drivers to move out of the HOV lanes. This strategy is currently in place on Utah HOV lanes.

- **Concurrent Flow, Barrier-Separated** – This configuration requires more investment than non-separated facilities, but it reduces HOV use violations. This technique enables the HOV lanes to run at significantly higher speeds because there are limited, defined entry and exit points.
- **Reversible Flow, Barrier-Separated** – Where right-of-way or budget limitations preclude the provision of barrier-separated lanes in both directions, reversible center lanes are sometimes provided to enable HOV operations in the peak direction.
- **Contraflow, Moveable Barrier** – A moveable barrier is used to separate one lane of the non-peak direction for use by HOVs traveling in the peak direction. This configuration requires openings in the freeway centerline to allow vehicles to enter and leave the contraflow lane.

- **Queue Bypasses** – A parallel lane is provided that allows HOVs to bypass toll plazas or ramp meters.
- **Shoulder Lane** – In some places HOVs are permitted to travel along a hardened freeway shoulder. This type is relatively uncommon because of frequent rear-end accidents with stalled vehicles.

Functional Class – HOV lanes are usually applied on freeways and freeway ramps, although in rare cases they have been implemented on arterials.

2.4 High Occupancy Toll (HOT) Lanes

Description – HOT lanes are HOV lanes where single occupant vehicles are permitted to use for a fee. The tolls are electronically collected (no toll booths required) and vary depending on the degree of congestion. Video cameras are used to detect violators and to produce evidence used to assess fines.

Functional Class – All of the current applications are barrier-separated lanes in the median of freeways.



Barrier-separated HOT Lane
Interstate 15,
San Diego,
California

2.5 Toll Roads

Description – Toll roads are any roadways for which a direct user fee is charged. In the past, tolls were collected by hand by attendants in gated tollbooths. While this system persists on some older facilities, most new toll roads rely chiefly or entirely on electronic toll collection (ETC) methods. ETC methods take up less space and do not require vehicles to stop. Worldwide, about half of all peak-hour tolls are now collected electronically.

Nationally, there are more than 4,800 lane-miles of tolled roads, tunnels, and bridges in 29 states. The strategy is very common abroad; many countries (including Korea, Mexico, Italy, and Argentina) toll between 90 and 100 percent of their freeways, while others (such as Japan, France, Spain, Malaysia, and South Africa) toll between one-third and two-thirds of their systems.

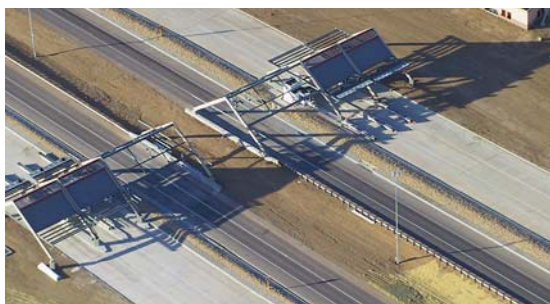
Functional Class – Tolls are usually applied to freeways, bridges, and tunnels. However, there is a special type of tolling (cordon pricing) that is sometimes applied to all roads in a specific geographic area regardless of functional class.



HOT Variable Pricing Sign
SR-91 Express
Lanes, Orange
County, California



Toll Bridge
Delaware
Memorial, New
Castle, Delaware



Electronic Toll Collection Plaza
E-470, Denver,
Colorado



Cordon Pricing
City Center
London, England

2.6 Cordon Pricing



Description – A cordon is marked around a geographical area, typically the downtown area of a city, and a charge is collected from every vehicle that uses the roads within this area during certain hours. Electronic vehicle detection equipment is set up on all roads crossing the cordon, with additional equipment inside the perimeter to detect vehicles making internal trips. Vehicle owners are subject to fines if they use cordon-area streets without paying the fee. Certain types of vehicles (buses, emergency vehicles) are typically exempt, and residents of the cordoned zone are sometimes offered discounts.

Functional Class – All road classes within a designated area.

Cordon Pricing Sign
City Center
London, England



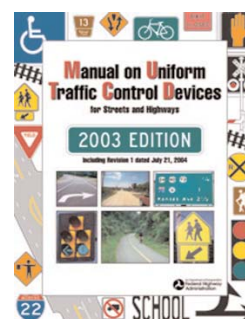
Chapter 3 - Literature Review & Case Studies

3.1 Review Process

The purpose of the literature review and case studies is to determine the state of the practice for managed lanes facilities and to document what works well and under what conditions. The review involved a literature review as well as corridor specific research. The corridor specific research involved reviewing studies and contacting managed lanes agencies, as well as visiting several managed lanes projects on a facility tour of Houston, San Diego, and Denver.

3.2 Literature Review

A literature review was conducted of relevant research on the topic of managed lanes. Managed lanes are increasingly being seen as an effective solution to many of the issues confronting transportation agencies across the country, and this greater interest has spurred recent research efforts. The goals of the literature review were to learn about the latest applications of managed lanes strategies throughout the country, to identify what has been tried and what is working, and to identify the strategies and methods that are applicable to the conditions confronting UDOT.



The literature review identified managed lanes strategies that are applicable to conditions confronting UDOT

This information was also used to develop screening criteria. As will be discussed in greater detail in Chapter 4, a sketch planning process was created to identify potential corridors from among the state highway network. A three-phase screening process was developed, with a finer-grained analysis used to evaluate the candidate corridors and eliminate unlikely corridors. The first two phases of this process borrowed heavily on the criteria and processes that have been tried and used successfully elsewhere in the United States.

The literature review included transportation planning journals such as the Institute of Transportation Engineers (ITE) Journal, National Cooperative Highway Research Program (NCHRP) reports, research conducted as part of the USDOT/FHWA Value Pricing Pilot Program, the work of leading transportation research institutes such as the Texas Transportation Institute (TTI), public transportation policy institutes such as the Reason Public Policy Institute (RPPI), and state transportation agencies such as the Maryland Department of Transportation and the Colorado Tolling Enterprise (CTE).

Key managed lanes national publications are listed below:

A Policy on the Geometric Design of Highways and Streets, AASHTO, 2001

This national design standard contains regulations and guidelines for the implementation of reversible lanes and HOV facilities. This reference specifically supplies details of managed lanes cross-sections, terminals, and reversible lane directional split recommendations.

MUTCD for Streets and Highways, FHWA, 2003

This national standard reference contains signing and striping standards for HOV lanes and reversible roadways.

HOV Systems Manual, NCHRP Report 414, 1998

This comprehensive manual provides extensive information regarding planning, designing, implementing, operating, marketing, and enforcing HOV systems.

Guide for the Design of High Occupancy Vehicle Facilities, AASHTO, 1992

This publication provides information on the planning, design, and operational considerations for HOV facilities. However, the information presented in this publication is more concise than comprehensive.

A Guide for HOT Lane Development, FHWA, 2003

This comprehensive manual includes information regarding the planning and implementation process, organizational frameworks for projects, public acceptance issues, technical issues, operational issues, and lessons learned from actual HOT lane projects.

State agencies are also beginning to adopt standards for implementing and studying managed lanes. The national publications tend to offer broad or generic guidelines for implementing managed lanes; whereas, state managed lanes publications provide more detailed examples of managed lanes practice. Examples of these state publications are listed below:

High Occupancy Vehicle Guidelines, Caltrans Division of Traffic Operations, 2003

This publication contains the California Department of Transportation's (Caltrans) HOV lane guidelines. It includes Caltrans policy, such as, "The Department will consider a HOV lane alternative for all projects which add capacity to metropolitan freeways," as well as state and national codes. The publication provides standards for planning, operations, geometric design, enforcement, and other HOV related issues.

Colorado Value Express Lanes Feasibility Study, CDOT, 2001

The purpose of this study was "to investigate the potential application of High Occupancy / Toll (HOT) Lane concepts on Denver-area corridors." The study describes the value express lane concept and eight corridors with medium or high potential for express lanes. The study finds that express lanes are technically and financially feasible on two corridors (I-25 and U.S. 36). The Colorado Tolling Authority (CTE) is also currently conducting a statewide potential tolling study.

Evaluation of the Effectiveness of High Occupancy Vehicle Lanes, Utah Department of Transportation (UDOT) Research Division, 2002

This report summarizes research conducted by the University of Utah for UDOT. The study reports HOV lane usage, occupancy, speeds, and violations. This study concludes that the HOV lanes on I-15 in Salt Lake County are a success.

Houston Managed Lanes Case Study: The Evolution of the Houston HOV System, FHWA, 2003

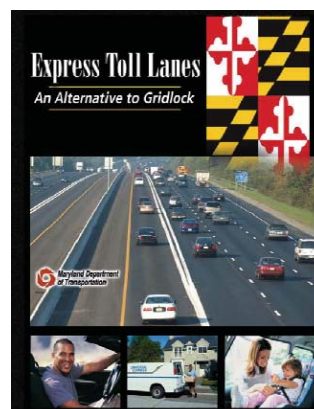
This case study summarizes the development, operations, and use of Houston's HOV lanes. It also presents issues associated with managed lanes, as well as institutional arrangements supporting the system.

Washington State Freeway HOV System Policy, Washington State Department of Transportation (WSDOT), 1997

This publication provides information about Washington's HOV history, policies and objectives. The majority of the document is devoted to outlining specific HOV policy such as minimum HOV lane thresholds, speed and reliability standards, carpool definition, and other related issues.

Express Toll Lanes: An Alternative to Gridlock, Maryland Department of Transportation (MDOT), 2004

An informative brochure, directed to the general public. This pamphlet contains general information on express lanes as well as information from projects around the country. The brochure addresses public concerns such as, "Will the electronic equipment invade people's privacy?"



The Maryland Department of Transportation is studying the feasibility of express lanes on the state's busiest highway segments

Because managed lanes are a constantly evolving topic, internet searches were used to obtain up-to-date information on current practices and projects. Over 100 websites were identified addressing some aspects of managed lanes implementation. The following five websites proved to be most valuable for the purposes of this study:

www.valuepricing.org

(FHWA - Site for all value pricing pilot projects from TEA-21, a comprehensive primer on what these state DOTs are doing)

www.tollroadnews.com

(Current events in U.S. and abroad, "sound bites" for quick reading)

www.managed-lanes.tamu.edu

(Managed by Texas Transportation Institute - TTI is a national leader in managed lanes research)

www.innovativefinance.org

(Resource for creative finance ideas geared toward state DOTs)



www.dot.state.co.us/CTE/index.asp

(A source of information on institutional issues and statewide plan results from Colorado, that is facing similar issues)

A list of additional useful web based sources is provided in the Appendix. The state of the practice for managed lanes strategies will be further summarized in the following sections.

3.3 Managed Lanes Case Studies

Nineteen case studies were selected as part of the national program review. The sections below describe the "lessons learned" from the managed lanes techniques considered as part of this study. Detailed reports from the nineteen case studies are provided at the end of each section.

Reversible Lanes

Objectives - Portions of a road network often have peak traffic flows that are much higher in one direction than the other in the morning, with the pattern reversing itself in the evening. This is particularly true of radial sections connecting downtowns to suburbs. In such cases, widening the road to accommodate the peak flow is inefficient because the capacity in the off-peak direction is essentially wasted. Reversing some lanes uses the excess capacity in the off-peak direction to serve excess demand in the peak direction. Thus, the target level-of-service can be achieved with lower construction costs and with fewer right-of-way impacts.

Capital Costs - These can vary dramatically by the devices used and the modifications to the roadway. For example, the moveable barrier for the Tappan Zee Bridge cost \$5 M, while implementing reversible lanes on Grant Road in Tucson cost only \$100,000. Estimated Capital Costs: \$10,000-\$1,000,000 per mile.

Operation & Maintenance Costs - Estimated Operation & Maintenance Costs: \$100-\$10,000 per mile. (Only includes maintenance to reversible facility equipment. Cost does not include general maintenance expenses such as resurfacing, etc.)

Start Date - Reversible lanes have been used in the U.S. for more than half a century. Some of the first installations were on bridges and tunnels, but lanes have been reversed on arterial streets in Honolulu since the 1950's.

- Signs (Only):** East 5th and 6th Streets (Tucson) 1968
- Cones:** Kapiolani Boulevard (Honolulu) 1952
- Tubes:** Golden Gate Bridge (San Francisco) 1963
- Moveable Barriers:** East R.L. Thorton Freeway (Dallas) 1991, Tappan Zee Bridge (New York) 1993, Coronado Bridge (San Diego) 1993
- Permanent Barriers with Gates:** Lincoln Tunnel (New York) 1953, Katy Freeway (Houston) 1984, Kennedy Freeway (Chicago) 1994



Project Locations - Reversible lanes are used in many cities in the U.S. Examples by facility type include:

Bridges: Golden Gate Bridge (San Francisco), Tappan Zee Bridge (New York), Chesapeake Bay Bridge (Maryland), Coronado Bridge (San Diego)

- Tunnels:** Lincoln Tunnel (New York), Caldecott Tunnel (Oakland), Chesapeake Bay Bridge-Tunnel (Norfolk, Virginia)
- Freeways:** Katy Freeway (Houston), I-15 (San Diego), I-64 (Norfolk), East R.L. Thornton Freeway (Dallas), H-1 Freeway (Honolulu), Kennedy Expressway (Chicago)
- Arterials:** Kapiolani Boulevard (Honolulu), Northside Drive (Atlanta), Grant Road (Tucson), 7th Street (Phoenix), Connecticut Avenue (Washington, D.C.)

Institutional Issues - A key issue limiting use of reversible lanes is reluctance of motorists to accept non-standard roadway cross-sections.



Reversible Lanes
have been
implemented
on bridges, such
as the Golden
Gate Bridge in
San Francisco, CA

Authority - Almost all departments of transportation have design authority that enables them to construct reversible lanes on new roads, and most have the authority to retro-fit such lanes on existing roads. Their reluctance to do so stems from several causes, the most important of which are:

- Only a limited portion of any given road network has enough directional peaking to justify the complexity of reversible lanes. Of these, some are arterials with left-turn movements that may be difficult to accommodate in combination with reversible lanes.
- Absent a genuine, long-term shortage of funds there is little reason for a DOT not to build equal capacity in both directions. Heightened cost consciousness is one reason why reversible lanes are common on tolled bridges and tunnels but not on facilities funded indirectly through taxes.
- There may be concerns about the DOT's liability in the event of accidents involving driver confusion. Such concerns are inversely proportional to the degree of physical separation involved; low in the case where gates and barriers prevent drivers from entering in the right direction, and high where there are no physical barriers between the directions of flow.
- Reversible lanes have higher operating costs than conventional lanes due to the additional equipment involved (gates, variable signs, etc.)

Public Reaction - The case for reversible lanes is easily understood by motorists in bumper-to-bumper traffic who can see empty lanes on the other side of the centerline. However, this type of public pressure applies only to existing facilities. Thus far there has been little public pressure to have reversible lanes built into the design of new facilities, apparently due to the public's lack of understanding of how the difference in cost would affect them individually.



Cases of negative public reaction occur when reversible lanes cause operational problems to motorists

There have been cases of negative public reaction when reversible lanes are retro-fit onto arterial streets with significant left-turn movements. Tucson retro-fit reversible lanes on three arterials using signage only (no cones, tubes, or physical barriers) and experienced problems with left-turn movements. Eventually these were converted back into left-turn lanes. It is worth noting, though, that all three of the Tucson reversible lanes were instituted as "temporary" measures but remained in force for over a decade, in one case 23 years. This implies that their operational problems were not severe enough to require immediate action. It is also worth noting that although safety concerns were cited as a reason for removing the reversible lanes, the accident rate more than doubled when the reversible lanes were converted back to conventional lanes.

Environmental Issues - Reversible lanes are typically used on radial routes so one argument is that they facilitate long-distance commuting by car and thus have a negative impact on the environment (as would any capacity-increasing measure on these facilities). This argument only holds true if, in the event that reversible lanes were not provided, the same commuters would either live closer to work or would use a different mode of travel. If there is reason to believe that the commuters would not alter their work and home locations in response to freeway level of service, then reversible lanes incur the fewest right-of-way impacts for a given level of service, and so can be considered environmentally friendly.

Other - The best example of a state-of-the-art reversible freeway is the Tampa-Hillsborough County Expressway, currently under construction. A 3-lane viaduct is being constructed in the median of an existing tollway. When finished, the viaduct will be operated as a one-way facility inbound towards downtown Tampa in the morning and outbound in the evening. The project features all-electronic tolling, automatic gates, and drop-down safety nets. It is modeled after equipment used on aircraft carriers to safely stop any cars that pass through the closed gates and attempt to enter in the wrong direction.



Reversible Lane Case Study	
1. Project Name - 7th Street Reversible Arterial	
2. Managed Lane Strategy - Reversible Lanes	
3. Contact - Jim Sparks, City of Phoenix Deputy Street Transportation Director (602) 262-4435 http://phoenix.gov/	
4. Project Location - Phoenix, AZ	5. Functional Class - Urban Arterial
6. Objectives - Alleviate congestion and improve flow in the peak direction	7. Capital costs - \$100,000
8. Start Date - Mid 1970's	9. Operating costs - \$100-200/year
10. Project Description <p>7th Street was built in the 1950's with 64 feet of right-of-way. In the mid 1970's a new freeway was proposed to be built through downtown (I-10). The public voted against this measure, and in an effort to alleviate congestion, the mayor encouraged the city's traffic engineers to come up with a creative solution to solve downtown congestion. One of the results was an eight-mile reversible traffic lane on 7th Street. Currently 7th Street operates as a six lane arterial. From 6-9 AM three lanes operate inbound and three lanes outbound. In the evening from 4-6 PM four lanes are designated outbound and two lanes inbound. During these hours of the day left turns are permitted between signalized intersections, but not at the signalized intersections. There is no designated turn lane during the hours of reversible operation. Left turns can obstruct thru-traffic. Accident rates on 7th Avenue are average when compared with other Phoenix arterials.</p>	
11. Public and/or Institutional Issues Public Perspective <p>Neighborhood residents were initially in favor of the reversible lanes because severe traffic congestion was causing commuter neighborhood cut through traffic. Nearly unanimous approval of the reversible lanes continued for 15 years. However, in recent years, neighbors have begun complaining that prohibiting left turns at signalized intersections is causing cut through traffic. The reversible lanes in Phoenix do not prohibit left turns for the entire length of the reversible section (only at signalized intersections). Allowing mid-block left turns has reduced neighborhood and business resistance to reversible lanes. However, the reversible lane creates a somewhat hostile pedestrian environment due to the elimination of a center-lane island.</p> Government Perspective <p>When the reversible lanes were first initiated government officials were concerned about the significant increase in accidents on 7th Street. An extensive public education campaign was launched and accident rates declined to normal levels. The implementation of one reversible lane on 7th Street was an inexpensive way to increase capacity. In a recent city council meeting neighbors complained of cut through traffic due to the reversible lanes. Staff explained that the reversible lanes were implemented to lower congestion and help reduce cut through traffic. The cut through traffic argument became a moot point.</p>	
12. Other <p>Reversible lanes can be managed using variable electronic signs or fixed (static) signing. The electronic signing improves the versatility of the reversible lanes (i.e. more than one lane may be reversible) but is considerably more expensive. Phoenix uses fixed overhead signs placed every quarter mile to designate reversible lanes. 7th Street does not receive special police attention or enforcement funding because accident rates have historically been average along the reversible corridor.</p>	

Reversible Lane Case Study

1. Project Name - Kennedy Expressway (Interstate Route 90/94)



2. Managed Lane Strategy - Reversible Lanes

3. Contact - Jacek Tyszkiewicz, Express Lanes, IDOT (847) 705-4024
<http://www.chipublib.org/004chicago/timeline/kennedyx.html>

4. Project Location - Chicago, Illinois

5. Functional Class - Urban Expressway

6. Objectives - Reduce travel time delays

7. Capital costs - \$237 million
 (Total costs of new 16-mile freeway)

8. Start Date - 1960

9. Operating costs - \$1.9 million (2002)

10. Project Description

The 16-mile Kennedy Expressway (originally named Northwest) was built in 1960 to provide a direct route from the Congress Expressway (later renamed Eisenhower) to the O'Hare International Airport. The two median express lanes between Ohio Street and the Eden's Expressway (seven miles) operate as reversible lanes. In February of 1970 a rapid transit line was implemented in the Expressway's median. Major expressway reconstruction was completed in October of 1994. The reconstruction increased the number of entry ramps to three in each direction and included mechanized closure of entry ramps along the expressway's reversible lanes. The operation of the reversible lanes is controlled by the sophisticated REVLAC system (see REVLAC description below). As the REVLAC system prepares to switch the direction of the reversible lanes, an emergency response vehicle travels the seven-mile segment to ensure that no cars are trapped or stalled in the reversible median.

11. Public and/or Institutional Issues

Authority

The Kennedy Expressway is managed by the Illinois Department of Transportation (IDOT) District 1 ComCenter. The reversible lane direction is managed using live visual and audio communication equipment. During the peak hours of the day both directions are regularly heavily congested. The reversible lanes generally serve the outbound direction in the evening and the inbound direction in the morning. The direction of the reversible lanes, however, may be changed based on incidents, congestion levels, and demand from adjacent freeways. The ComCenter regularly reviews queuing and congestion on the Kennedy Expressway to better serve the driving public.

Public Perception

According to Jacek Tyszkiewicz the public generally approves of the reversible lanes. The public, however, sometimes complains that the reversible lanes do not serve the right direction. It can take up to an hour to switch the direction of the reversible lanes, if there is an incident. Because the system is flexible, the public expects the reversible lanes to respond quickly to changing traffic conditions.

12. Other

REVLAC (reversible lane and control) controls barriers, changeable message signs, auxiliary signs, swing gate heaters, weather station warning signals, CCTV monitoring system, alarm systems, circuit breakers, and power supply systems. REVLAC automatically moves gate arms and barriers so that the reversible expressway operates without manual labor. The system also alerts the traffic operation center if a car crashes into a gate. The REVLAC system uses signing and barriers to prevent vehicles from entering the median in the wrong direction.

Reversible Lane Case Study

1. Project Name - Grant Road



2. Managed Lane Strategy - Reversible Lanes

3. Contact - Michael Graham, Tucson DOT Public Information (520) 791-4371
<http://dot.ci.tucson.az.us/grntrevln/sld007.htm>

4. Project Location - Tucson, AZ

5. Functional Class - Urban Arterial

6. Objectives - Alleviate congestion and improve flow in the peak direction

7. Capital costs - \$80,000

8. Start Date - 1981

9. Operating costs - \$100-\$200/year

10. Project Description

The implementation of reversible lanes on Grant Road began in 1981 as a temporary measure prior to expectant road widening. The road, however, was never widened and the reversible lanes became permanent. The reversible lanes were eliminated in June 2004. Grant Road is a five-lane surface arterial with signals. For four miles the center lane was reversible. The center lane served westbound traffic between 7 and 9 AM and eastbound traffic between 4 and 6 PM. All left turns, both mid-block and at intersections, were prohibited during these peak four hours of the day. Left turns were prohibited by signing. The remainder of the day the center lane functioned as a two way left turn lane.

11. Public and/or Institutional Issues

Business Perspective

Business owners along Grant Road complained that the restriction on left turns adversely affected their business.

Neighborhood Perspective

The residential neighborhoods adjacent to Grant Road complained of cut through traffic due to rerouted left turns. Horn honking, traffic queuing, and other traffic disruptions due to new or confused drivers in the area also caused concern.

Commuter Perspective

The reversible lanes on Grant Road reduced congestion. They reduced the average delay per vehicle by 112 seconds. Reduced congestion often results in increased safety. Broadway, another local arterial, was previously a reversible lane. Rear-end accidents increased by 250% with the conversion of Broadway into a non-reversible roadway (2001).

Government Perspective

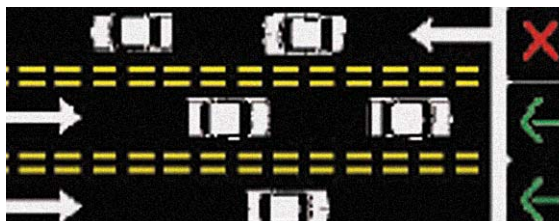
The Tucson DOT favors the reversible lanes because they are a relatively inexpensive solution to congestion. However, most town hall meetings were attended by residents opposing the reversible lanes. An April 2004 city council meeting determined that the reversible lanes on Grant Road would be eliminated by June 2004. The conversion took place as scheduled in June 2004 over a weekend. It was back to a two-way, left-turn lane for the Monday morning commute. An extensive public awareness effort took place including signage, press releases and news channel coverage.

12. Other

The average directional split on Grant Road was 43/57 (AM) and 56/44 (PM). The reversible lane on Grant Road was enforced by the Tucson police department. Grant Road did not receive special police attention or enforcement funding because accident rates have historically been average along the reversible corridor.

Reversible Lane Review Case Study

1. Project Name - Northside Drive



2. Managed Lane Strategy - Reversible Lanes

3. Contact - Kathy Bailey, Georgia DOT, (404) 635-8134

<http://www.dot.state.ga.us/dot/operations/traffic-safety-design/SpecialSubjects/nside.shtml>

4. Project Location - Atlanta, Georgia

5. Functional Class - Urban Arterial

6. Objectives - Congestion relief with limited right of way

7. Capital costs - \$50,000-\$100,000

8. Start Date - Mid 1990's

9. Operating costs - \$100-\$500/year

10. Project Description

Northside Drive has a three lane cross section. The road is located in an area with vertical curves and houses located close to the right of way. The center lane serves southbound travel between 6:30 and 9:30 AM and northbound travel for most of the remainder of the day. There is a transition time immediately prior to 6:30 and after 9:30 AM when the center lane functions as a two-way left turn lane. Lane direction is assigned using 10 changeable overhead signs spaced approximately one-quarter mile apart (see above figure). The overhead sign displays the following messages:

Green: Travel permitted, **Yellow:** Transitional turning lane, **Red:** Travel prohibited

11. Public and/or Institutional Issues

Institutional Issues

North Atlanta High School is located at the northern end of the corridor and Atlanta Memorial Park is located on both sides of the central portion of this corridor. Several historic houses are also located along the reversible corridor. Obtaining additional right of way would be difficult at this location.

Public Perception

Commuters and neighborhood residents do not like the reversible road according to the Georgia DOT. New drivers to the area are confused by the changing lane assignment. This issue is compounded by the fact that the visibility of the overhead lane designation signs is often obstructed by rolling hills and tree branches. Even experienced drivers avoid using the center lane as often as possible to avoid the risk of head-on collisions.

Government Perception

The road does not meet current design standards, with insufficient sight distance and other operational problems. When bulbs burn out in the overhead signs they require quick replacement. The span wires supporting the overhead signs are starting to fray and will soon require replacement. In addition, traffic has been declining since the implementation of reversible lanes. Congestion has diminished on the road to the point where reversible lanes may no longer be justifiable.

12. Other

Yearly maintenance costs are low because the system has not received a major update since it was initially installed. Light bulb replacement for the overhead electronic signs is one of the few maintenance costs. The system, however, will require major renovations or removal in the near future.



Houston introduced HOV lanes to its motorists in the 1980's

High Occupancy Vehicle (HOV) Lanes

Objectives - The objective of HOV lanes is to increase the people (as opposed to vehicle) moving capacity of a facility. Some literature suggests that HOV lanes may contribute towards other goals, such as reducing congestion in the general purpose lanes or improving air quality.

Capital Costs - These can vary dramatically by the environmental conditions, such as grade separation, available right of way, and/or modifications to the roadway. Estimated Capital Costs: \$1.5 million per mile.

Operating and Maintenance Costs - Estimated Operation & Maintenance Costs: \$20,000 per mile.



Start Date - The first HOV facility in the U.S. (1969) was the reversible busway in the median of the Shirley Highway (northern Virginia), followed closely (1970) by the toll plaza bypass to the San Francisco-Oakland Bay Bridge. In 1973 an HOV lane on SR 520 in Seattle was opened to operation. In 1976 there was a short-lived experiment with HOV lanes on the Santa Monica Freeway near Los Angeles.

In the 1980's, HOV lanes were introduced to the Houston (Katy Freeway) and San Jose (SR 237) areas. Many states (New Jersey, Maryland, Tennessee, for example) began operating HOV lanes in the early 1990's after the passage of ISTEA made it relatively easy to obtain federal funding for this type of project.

Project Locations - HOV lanes are used in at least twenty states and three Canadian provinces. More than 2,500 lane-miles of HOV facilities exist in the U.S. and Canada, and thousands more in other parts of the world. Examples include:

- **Concurrent Flow, Buffer or Non-Separated:** Houston (I-610), Seattle (I-5), Los Angeles (I-10), Salt Lake City (I-15), Northern Virginia (I-66 west of I-495)
- **Concurrent Flow, Barrier Separated:** Houston (I-610), Seattle (I-90), Los Angeles (I-10)
- **Reversible Flow, Barrier Separated:** Denver (I-25), Minneapolis (I-394), Pittsburgh (I-279)
- **Contraflow, Moveable Barrier:** Honolulu (H-1), New York (I-495), Dallas (I-30), Boston (I-93)
- **Queue Bypasses:** San Francisco/Oakland Bay Bridge Toll Plaza, Los Angeles (over 250 freeway ramps)
- **Shoulder Lane:** Seattle (SR 509), Santa Clara County California (Capitol Expy, Lawrence Expy)

Institutional Issues - Several pieces of legislation were critical to the growth in HOV lanes in the U.S. The first were the amendments to the Clean Air Act of 1990 that listed HOV lanes as a transportation control measure that could be used by states to attain federal air quality standards. The second was the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 which made HOV lanes eligible for Congestion Mitigation and Air Quality (CMAQ) funds in regions not attaining federal air quality standards. ISTEA also provided that HOV lanes would be eligible for 90 percent federal matching funds, while reducing the federal funding ratio for general purpose lanes. During the ISTEA debates, a proposal was made that states using federal funds to build HOV lanes should refund the money if the lanes were later converted to general purpose lanes. This proposal failed, but a similar proposal was later passed (1994) when it became clear that "backsliding" might become a problem.

Authority - Almost all state departments of transportation have design authority that enables them to construct HOV lanes on new roads, and most have the authority to retro-fit such lanes on existing roads. Enforcement of HOV lanes may necessitate new legislation that makes it a crime to violate HOV restrictions.

If HOV lanes have been built using federal funding then the state cannot unilaterally convert them to mixed flow lanes. It must either repay the federal government for its share of the investment or obtain a waiver from United States Department of Transportation (USDOT).

Public Reaction - Public reaction to HOV lanes has been mixed, with easy acceptance in some places and notable failures in others. Several factors seem to account for the different reactions:

Conversion of an Existing Lane versus Adding a New Lane: Probably the worst public reaction to an HOV lane occurred in 1976 when the California DOT (Caltrans) converted one lane of the Santa Monica Freeway in each direction to HOV operation. Traffic in the general flow lanes, slow prior to conversion, became stop-and-go afterwards. Caltrans was lambasted in the media, sued by irate motorists, and eventually was court-ordered to end the experiment after only 21 weeks. This was despite the fact that the HOV lanes were, in fact, reasonably successful. They carried nearly as many people as the other lanes combined, bus ridership tripled, and the freeway carried more people in fewer vehicles than at any time in the decade before or after the experiment.

Caltrans has since adopted a policy of introducing HOV lanes only when new lanes are added to a facility. This policy has enabled Caltrans to build over 1000 miles of HOV lanes, more than any other state, with only moderate opposition. A recent (2002) survey in the San Francisco area found that 57 percent of all motorists supported carpool lanes on freeways, but that 70 percent of respondents opposed converting existing lanes to HOV lanes.

Volume on HOV Lane: Heavily-used HOV lanes are generally well accepted by the public. However, if HOV lanes appear empty, officials will be pressured to convert them into conventional or HOT lanes. Still, "empty" is largely a matter of perception. A survey in the San Francisco area found that 74 percent of drivers in the conventional lanes felt that the HOV lanes were underutilized while only 30 percent of HOV lane users agreed.



UDOT kicked off a carpool campaign to promote HOV usage along I-15



**The
Environmental
Issues** of HOV
lanes may vary
depending on
the assumed
alternative

Enforcement - HOV lanes can quickly become discredited if they are not adequately enforced. Violations were particularly troublesome in the early 1990's, with violators exceeding 30 percent of the vehicles in HOV lanes in facilities in Florida, Virginia, Texas, New Jersey, and Washington. This led to suggestions that states failing to enforce HOV laws should refund federal construction monies spent for HOV lanes. Since that time, enforcement efforts and fines for violations have been increased and violations have been reduced to a national average of 13 percent of HOV traffic. Further consideration should also be given to the idea of more effectively enforcing tollways through administrative actions. For instance, in Texas the Toll Authority can hold a vehicle registration renewal until toll violations are paid.

Bus advocates sometimes oppose HOV lanes because they increase driving speeds for some autos and therefore reduce the incentive to switch to transit.



Environmental Issues - Whether HOV lanes have positive or negative impacts depends on the assumed alternative. If the assumed alternative is for the same number of travelers to drive separately, leading either to lower speeds or road widening, then HOV lanes will be considered environmentally friendly.

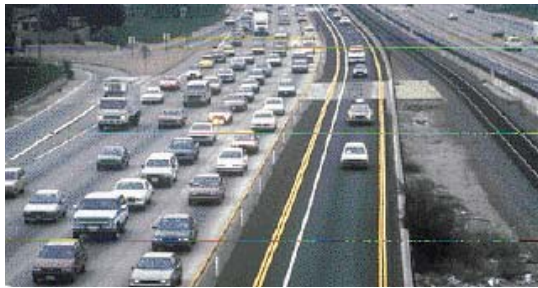
On the other hand, because HOV lanes are typically used on radial routes, the argument could be made that they facilitate long-distance commuting by car and thus have a negative impact on the environment (as would any capacity-increasing measure on these facilities). This argument would only hold true for add-a-lane projects.

Other - HOV lanes seem more susceptible than other managed lanes strategies to change over time. The HOV lanes on the Katy Freeway in Houston are a good example. They opened as bus-only lanes in 1984. Six months later they were made available to vanpools with four or more occupants; seven months after that the allowable occupancy was reduced to three, then nine months later to two. When volumes on the lanes increased to the point where speeds were being reduced, the requirement was set back to three occupants for the peak hours. Whether this is viewed as "backsliding" or management flexibility depends on one's point of view. Motorcycles, buses, and Inherently Low Emitting Vehicles (ILEV) are also frequently allowed to use HOV lanes.

In some cities (i.e., Washington, Houston, and San Francisco) HOV lanes have created the phenomenon of impromptu carpooling known as "slugging." A "slug" is a commuter who waits at a convenient place, usually a bus stop or park-and-ride lot, to be picked up by a driver who needs additional people to fulfill the HOV occupancy requirement. The driver ("body snatcher") either waits in a queue of similar drivers or, if no queue exists, waves a "riders wanted" sign to signal their willingness to accept passengers. Although slugging is not officially encouraged ("slug" is a derogatory term used by bus drivers referring to people who get a free ride using a counterfeit coin), it seems to work for a growing number of people in cities where HOV lanes offer significant travel time savings.

HOV Case Study	
1. Project Name - I-66	
2. Managed Lane Strategy - High Occupancy Vehicle (HOV) (2+ occupancy)	
4. Contact - http://www.virginiadot.org/comtravel/hov-novasched.asp	
3. Project Location - Northern Virginia (Fairfax and Arlington Counties)	5. Functional Class - Urban Freeway
6. Objectives - Encourage carpooling while reducing traffic congestion and air pollution	7. Capital costs - \$280 million
8. Start Date - 1982	9. Operating costs - NA
10. Project Description HOV lanes exist on I-66 in Northern Virginia between Route 234 in Manassas and the Theodore Roosevelt Bridge. These 2+ HOV lanes are non-barrier separated and function as part of a region-wide HOV system (see "Other" below). The HOV lanes on I-66 are divided into two segments with different operations. The western segment of I-66 between Route 234 in Manassas and I-495 (seven mile segment) provide one HOV lane for the peak direction. An HOV lane serves eastbound travel from 5:30 to 9:30 AM and westbound travel between 3:00 and 7:00 PM. The remainder of the day the HOV lanes function as general purpose lanes. The eastern three-lane, 10-mile stretch of I-66 between I-495 and Theodore Roosevelt Bridge is an exclusive HOV facility during peak commuter periods. All single occupant vehicles (SOV) traveling in the peak direction are not permitted to enter the facility. The exclusive HOV freeway serves the eastbound direction between 6:30 and 9:00 AM and the westbound direction between 4:00 and 6:30 PM. The remainder of the day these lanes operate as general purpose lanes.	
11. Public and/or Institutional Issues Public Perception Northern Virginia law enforcement receives more complaints regarding the enforcement of HOV lanes than any other issue (HOV Task Force 2003). A recent <i>Washington Post</i> survey of residents of northern Virginia indicated that 42% believed that congestion was bad enough to look for another place to live. 78% of northern Virginia drivers also indicated that they want two or more additional lanes built on I-66 in Arlington and Fairfax counties. Government Perception Several obstacles prevent the effective enforcement of HOV violations on I-66. Troopers writing tickets on the HOV lanes have been injured and even killed, due to narrow shoulders and fast moving vehicles (HOV Task Force 2003). Increased police officer duties related to heightened national security has made it difficult for police to enforce HOV lanes with current staff levels. Due to the high number of SOV exemptions (see Institutional Issues below) and difficulty collecting tickets, HOV violations have become rampant in northern Virginia. Institutional Issues The Dulles Toll Road (connecting to Dulles International Airport) terminates in the eastern HOV segment of I-66. The eastern segment is an exclusive HOV facility for the peak direction during peak hours, potentially limiting mobility to the airport. As of 1977 low occupancy vehicles traveling to and from the Dulles Airport were granted permission to use I-66 regardless of vehicle restrictions. The airport and its surrounding businesses have complicated the determination of legitimate SOV airport trips. State law also allows low occupant law enforcement vehicles to travel on the HOV lanes. A number of federal employees in the D.C. area consider themselves "law enforcement personnel" and travel in the HOV lanes as SOV. Inherently, low emitting vehicles with Virginia approved license plates are also allowed to use the HOV lanes regardless of the number of passengers. All of the above complicate enforcement of the HOV lanes.	
12. Other The I-66 HOV lanes are part of a HOV freeway network surrounding the Washington D.C. area. HOV lanes also exist on I-385, I-95, and the Dulles Toll Road in northern Virginia. The combined HOV freeway system serves a total of more than 37 thousand people during the HOV restricted periods.	



HOV Case Study	
1. Project Name - I-10 (El Monte Busway) San Bernardino Freeway 	
2. Managed Lane Strategy - High Occupancy Vehicle (HOV) (3+ occupancy)	
3. Contact - For additional information see: http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS-TE/13692.html or http://www.mta.net/trans-planning/CPD/HOV/1-lacounty.htm	
4. Project Location - Los Angeles County, California	5. Functional Class - Urban Freeway
6. Objectives - Originally intended for transit only	7. Capital costs - \$36 million
8. Start Date - 1973	9. Operating costs - \$175,000/year (bus service costs)
10. Project Description <p>The El Monte Busway on the San Bernardino (I-10) freeway serves buses and 3+ carpools between El Monte and downtown Los Angeles (11 miles). This Busway is part of a region wide HOV system (see "Other" below). Between El Monte and I-710 the Busway is separated from the general purpose lanes by a 10.5-foot painted buffer. Closer to downtown, from I-710 to the termini, the Busway is designated by striping but no buffer exists. The El Monte Busway opened in 1973 and originally allowed only buses to use the facility. For the first few years the transit lane was only operational during peak periods. In 1974, 3+ carpools were allowed to use the Busway due to a bus operator strike, and in 1976 the Busway was opened permanently to 3+ carpools. In 1981 the facility became operational for all hours of the day and all days of the week. Legislation in 1999 lowered the vehicle occupancy requirement to 2+ carpools, but the 2+ carpool requirement in 2000 proved to overburden the Busway lanes. The Busway has since returned to its 3+ vehicle occupancy requirement for all hours of the day.</p>	
11. Public and/or Institutional Issues Public Perception <p>In 2000, the occupancy requirement on the Busway was reduced to 2+ carpools and thousands of commuters were frustrated. Bus schedules were compromised and many 3+ carpools increased their travel time by 20 minutes. The increased congestion on the Busway also did not significantly improve congestion in the general purpose lanes. Thus, the 3+ occupancy rule was reinstated. In 2000, over 50% of the person-trips on the Busway were made by bus passengers.</p> Institutional Issues <p>The construction, financing, and operation of the Busway have been guided by a 1971 agreement between the Los Angeles County Metropolitan Transportation Authority (MTA) and Caltrans. The state was responsible for designing, constructing, operating, and maintaining the Busway, and MTA was responsible for designing, constructing, operating, and maintaining the bus stations and other bus elements of the projects. Caltrans continues to be responsible for operating and maintaining the Busway and the freeway.</p>	
12. Other <p>As of 2000, Los Angeles County had approximately 377 lane-miles of HOV freeway. The Metrolink rail system also operates in the corridor. Three bus stations are located along the Transitway at El Monte. A total of 15 park-and-ride lots in the corridor are oriented toward the Busway, providing some 5,100 parking spaces to travelers.</p>	

HOV Case Study

1. Project Name - I-15 High Occupancy Vehicle (HOV) lanes



2. Managed Lane Strategy - High Occupancy Vehicle (HOV) lanes (2+ occupancy)

3. Contact - Stan Burns, Utah DOT Research, (801) 581-7144
<http://www.dot.state.ut.us/download.php/tid=296/UT-03.26.pdf>

4. Project Location - Salt Lake City, Utah

5. Functional Class - Urban Freeway

6. Objectives - Increase vehicle occupancy and reduce travel times

7. Capital costs - Undetermined. The HOV lanes were constructed as part of a \$1.6 billion dollar I-15 reconstruction project.

8. Start Date - 2001

9. Operating costs - NA

10. Project Description

The I-15 HOV lanes extend from 10600 South in Sandy to 400 South in Salt Lake City (27 miles). These lanes opened in May 2001 and were completed along with major I-15 widening and reconstruction. One HOV lane serves each direction, and the HOV lanes are currently designated by signing and striping. Carpools (2+), transit vehicles, and motorcycles are allowed to use the lanes at all times. The HOV lanes have an average violation rate between 5% and 13%. Violation rates on the exclusive HOV entry ramps in Salt Lake City are higher than the rest of the corridor (20%). During the afternoon peak hour, drivers in the HOV lane have a travel times saving of 30% (6.5 minutes) and the HOV lane serves as many people as a general purpose lane in 44% of the vehicles. Drivers in the HOV lane could travel at free flow speed (70 mph) based on low congestion levels; however, drivers prefer to travel at slower speeds. The HOV drivers slow their speed because of the non-barrier separated nature of the facility. The striping on the HOV lane permits vehicles with two or more passengers to merge into the HOV lane at any location. The potential for continual merging and diverging in the HOV lane slows traffic. In fall 2004, HOV lanes extending to the Alpine Interchange in the south were completed. There are also plans to expand the current HOV lane to the north.

11. Public and/or Institutional Issues


Institutional Issues

The 2002 Olympic Games, hosted in Salt Lake City, accelerated major infrastructure improvements in the region, including the construction of the I-15 HOV lanes.

12. Other

Average occupancy on I-15 prior to the implementation of HOV lanes was 1.1. The average occupancy on I-15 is currently 1.3.



HOV Case Study	
1. Project Name - I-5 High Occupancy Vehicle (HOV) lanes 	
2. Managed Lane Strategy - HOV (3+ occupancy)	
3. Contact - Keith Morse, WSDOT Program Management, (206) 440-4750 http://www.wsdot.wa.gov/projects/I5HOVPiercetoTukwila/factsheet.htm	
4. Project Location - Seattle, Washington	5. Functional Class - Urban Freeway
6. Objectives - Manage increasing congestion	7. Capital costs - \$280 million (projected costs of all six stages)
8. Start Date - 1983	9. Operating costs - \$360,000/year
10. Project Description <p>I-5 currently has one HOV lane per direction from Seattle to 320th Street in Federal Way (30 miles). Only vehicles carrying three or more people (3+ occupancy definition) are permitted to use the HOV lanes. The non-barrier separated HOV lanes are being constructed in a six-stage process. Planning is currently underway to extend the HOV further south to the King/Pierce County line. The last stage of the HOV extension is currently under design, but funding for construction has not been determined. The I-5 HOV lanes are part of a region wide HOV system (see "Other" below). In the early 1990's, the I-5 HOV lanes were only a few miles in length and not very successful. In 1991 the HOV facility had several deficiencies: lack of travel time savings, low use, significant congestion, safety impacts to the mixed flow, and a 26% violation rate. As the facility continued to expand, usage increased. By 1995 near the downtown area, the I-5 HOV lanes carried 48% of the people on I-5 in only 21% of the vehicles. The most recently completed segment, from SR 516 to 320th Street, saves vehicles traveling in the HOV lanes eight minutes.</p>	
11. Public and/or Institutional Issues <p>Public Perception A survey of travelers indicated that even most of the respondents who said they normally drive alone are supportive of HOV lanes. The construction of new HOV lanes has slightly improved congestion in the general purpose lanes. After the completion of the HOV lanes between 320th Street in Federal Way and SR 516, drivers in the general purpose lanes achieved travel times saving of two minutes.</p> <p>Institutional Issues The initial construction of this facility was accelerated due to requests to improve bus service from Pierce County to Seattle and in reaction to a petition from one activist group demanding HOV lanes on I-5. When asked why HOV lanes were added, WSDOT responded that the portion of I-5 in King County is one of the busiest in the state. Enforcement is quite difficult in this corridor because the highway shoulders are narrow and there is little access for police to observe and ticket violators.</p>	
12. Other <p>The I-5 HOV lanes are part of a regional network. HOV lanes also exist on I-405 and I-90 in the Seattle area. Regional express buses and other transit facilities use the HOV lanes.</p>	

High Occupancy Toll (HOT) Lanes

Objectives - The main objective of HOT lanes is to maximize the utility of HOV lanes. The excess capacity of HOV lanes is sold to vehicles with fewer occupants than the HOV threshold. Variable toll rates are used to ensure that the speeds for all vehicles in the HOV lanes will remain high. As congestion increases in the general purpose lanes, the demand to use the HOT lanes will increase, and therefore, the HOT tolls will also increase to preserve a specified level of service (frequently LOS C).



***HOT lanes**
maximize the
utilization of
HOV lanes*

HOT lanes, as described in a report by the Reason Public Policy Institute, should enable agencies to phase in congestion pricing as necessary. Given current trends and projected growth in vehicle trips and vehicle miles of travel, road space may need to be allocated by price (as is other public infrastructure). To improve the transition for public, these lanes may be applied gradually over a period of years when needed based on heavy congestion within other tolled lanes.

Capital Costs - These can vary dramatically by the environmental conditions, such as grade separation, toll devices used, available right-of-way, and/or other modifications to the roadway. Estimated Capital Costs: \$1.5 million per mile.

Operating and Maintenance Costs - Estimated Operation & Maintenance Costs: \$250,000 per mile.

Start Dates -

- SR 91 (Orange County, CA): 1995
- I-15 (San Diego, CA): 1996
- Katy Freeway (Houston, TX): 1998
- Northwest Freeway (Houston, TX): 2000

Project Locations - There are at least four HOT lane facilities currently in operation and several more close to implementation:

- **SR 91 (Orange County, CA):** A private consortium built and operated four express lanes in the median of a 10-mile section of existing highway. All private vehicles are tolled, but HOV 3+ receive a discount. The original agreement with the private consortium included a “non-compete” clause, that effectively barred the public agency from expanding the capacity on parallel facilities for the duration of the contract. When it became apparent that congestion in the corridor had deteriorated to the point where capacity improvements on the parallel facility were needed, the HOT lanes were bought back by the local transportation authority, so that the improvements to the parallel facilities could be made.

FINAL REPORT

FasTrak in San Diego provided a solution to the underused HOV lanes



- **I-15 (San Diego, CA):** The I-15 FasTrak was made by conversion of existing underused HOV lanes. HOVs use the lanes for free, while single-occupant vehicles pay tolls ranging from 50 cents to 4 dollars depending on congestion levels. The two FasTrak lanes are eight miles long and are reversible.
- **Katy Freeway (I-10, Houston, TX):** The Katy Freeway HOV lane was heavily used as an HOV 2+ lane, but underused when restricted to HOV 3+. A balance was achieved by allowing vehicles with two occupants to use the lane for 2 dollars per trip, while HOV 3+ vehicles continued to have free access to the lane. The lane is 13 miles long and is reversible.

- **Northwest Freeway (US290, Houston, TX):** A 15.5 mile reversible lane was converted much like the Katy Freeway. Vehicles with two occupants use the lane for 2 dollars per trip, while HOV 3+ vehicles continue to have free access to the lane.

Institutional Issues - HOT lanes face more complex institutional issues than other types of lane management strategies because they combine features of HOV lanes, congestion pricing, and sometimes private investment in public infrastructure for a single project.

Public Reaction - Although HOT lanes appear to be a win-win proposition (some motorists are helped; none are hurt), they have nevertheless met opposition in some places. For example, in 1997 the Minnesota legislature authorized a demonstration project on the I-394 HOV lanes, but later cancelled it due to public opposition. The cancellation occurred but was reversed in 2003 due to increased public support for non-tax methods of raising funds to relieve traffic congestion. Where negative reaction occurs it is likely due to some combination of the following four factors:

- The term "Lexus lanes" is sometimes used by HOT lane opponents to express the opinion that HOT lanes are only for the wealthy. Addressing this argument, a recent San Diego public opinion poll showed that the majority of residents across all socio-economic levels approve of HOT lanes.
- Current HOV lane users may feel that allowing other traffic into their lanes will force them to drive more slowly. This can be countered by adjusting the toll to ensure that the HOV lanes continue to operate at near free-flow conditions even after conversion to HOT operation.
- Other opponents object to toll roads in general, as in the Minnesota case. The usual basis for their argument is that the roads have already been paid for through taxes. This argument is usually countered by using the toll revenues to pay for future improvements that are not yet funded.

- Several HOT lane proposals (in northern Virginia, for example) were opposed because they were put forward by private companies, with the assumption that for-profit investments must necessarily be against the public interest. The argument is that HOT lane investors would have some financial interest in maintaining congested conditions on the free lanes that compete with their service.

Public reaction is also a function of the assumed alternative. The American Automobile Association opposed the introduction of HOT lanes in northern Virginia until it became apparent that freeway expansion could not be funded any other way; they now support HOT lanes. Similarly, the cancellation of Minnesota's I-394 HOT lanes, referred to above, was itself reversed in 2003 in response to growing public support for a non-tax method of raising funds to relieve traffic congestion.

Recent coverage in *USA Today* and *The New York Times* are consistent with the trend toward public acceptance of HOT lanes. The *USA Today* article stated that the poor image of HOT lanes is diminishing due to an inadequate federal gas tax, increased ease in collecting tolls and a more efficient and less expensive solution than building new lanes.


Environmental Issues - The environmental impact may be positive or negative depending on the time horizon chosen:

- In the short term, the HOT lanes may reduce pressures to widen freeways, which is an environmentally positive result.
- In the medium term, HOT lanes make long commutes more viable, and so may encourage some people to live further from their workplace than they otherwise would, which is an environmentally negative result.
- In the long term, HOT lanes create public awareness and experience with the positive aspects of road pricing (convenience, non-tax funds for projects). This may lead to further road pricing strategies, which would be environmentally beneficial.



HOT lanes
may reduce pressures to widen freeways, and in turn, positively affect the environment



HOT Case Study	
1. Project Name - I-15 High Occupancy Toll (HOT) Lanes 	
2. Managed Lane Strategy - Reversible High Occupancy Toll (HOT) Lanes	
3. Contact - Derek Toups (619) 699-1907, www.sandag.org/fastrak	
4. Project Location - San Diego, California	5. Functional Class - Urban Freeway
6. Objectives - Maximize the use of the existing capacity on the HOV lanes and provide travel choices for I-15 commuters	7. Capital costs - \$9.95 million (total cost of the three year demonstration program)
8. Start Date - Originally opened in October 1988 as HOV. Converted to HOT in 1996.	9. a) Operating costs - \$1.3 million b) Revenue - \$2 million
10. Project Description <p>The I-15 FasTrak™ Program allows solo drivers to pay a per trip fee to use the existing reversible HOV lanes located in the center median. The mainline freeway consists of four lanes in each direction. The HOT facility consists of an eight-mile stretch of two barrier separated lanes in the freeway median between SR 163 and Ted Williams Parkway. Access to the HOV lanes is available only at the two endpoints of the facility. The fee varies based on time of day and traffic levels in the HOV lanes. Fees are set to preserve LOS C conditions in the HOV lanes. I-15 is a major north-south freeway in the San Diego, CA region. The I-15 HOV lanes operate in the southbound direction (inbound commute) from 5:45-11:00 AM and the northbound direction (outbound commute) from 1:00-7:00 PM. The reversible facility is closed during off-peak hours and all day on weekends and holidays. Usage of the facility is limited to 2+ carpools and vanpools, buses, motorcycles, and authorized SOV project participants.</p>	
11. Public and/or Institutional Issues <p>Institutional Issues The San Diego Association of Governments (SANDAG) is responsible for overall project coordination and management. Caltrans is a primary project partner responsible for overseeing design specifications, physical improvements, and facility operations. The California Highway Patrol (CHP) provides enforcement, and the San Diego Metropolitan Transit Development Board (MTDB) assists in the planning and implementation of transit service improvements funded by the project.</p> <p>Public Perception According to a 2001 SANDAG survey, 66% of non-users and 88% of HOT lane users approve of the I-15 HOT lanes. When asked what was “the single most effective way to reduce congestion on I-15” HOT lanes were the top choice. I-15 HOT lanes are popular even with residents making less than \$40,000 per year. Eighty-one percent of low income voters agreed with the statement, “People who drive alone should be able to use the Express lanes for a fee.” FasTrak customers’ primary complaints are that the electronic toll display signs are too small and difficult to read and that the requirement to merge in and out of the separate FasTrak toll lane is difficult or inconvenient.</p> <p>Government Perception California Senate Bill 313, enacted in September 2001, eliminated the sunset date for the program. This law allows SANDAG to continue value pricing on I-15 indefinitely, subject to federal approval.</p>	
12. Other <p>Prior to this study, California state law prohibited low occupancy vehicles from traveling in high occupancy vehicle lanes. New state legislation allows SOV to use the HOV lanes for a fee.</p>	

HOT Case Study

1. Project Name - I-10 / Katy Freeway



2. Managed Lane Strategy - Reversible High Occupancy Toll (HOT) Lanes

3. Contact - David Fink, TxDOT, <http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS-TE/hot/chapter-7.htm>

4. Project Location - Houston, Texas

5. Functional Class - Urban Freeway

6. Objectives - Improve HOV lane utilization

7. Capital costs - \$362,389 (1997)

8. Start Date - Originally opened in 1984, as HOV. HOT lanes started in January 1998.

9. a) Operating costs - \$100,000
b) Revenue - \$94,000 (2001)

10. Project Description

The Katy HOV lane is a 13-mile, barrier-separated, reversible HOT lane located in the freeway median in the Houston area. The original HOV facility opened in stages between 1984 and 1990. Three park-and-ride lots and three park-and-pool lots are located along the corridor. Access and egress is provided by both slip ramps and direct access ramps. Initially only buses and authorized vanpools were allowed to use the HOV lane, leading to underutilization of the lane. Currently 2+ carpools are allowed to use the HOV lanes for free during off peak hours. Between 6:45 - 8:00 AM and 5:00 - 6:00 PM; however, the HOV lane is restricted to 3+ vehicles and paying 2+ vehicles. Single occupant vehicles are not permitted to use the facility at any time. QuickRide was launched on January 26, 1998 allowing two person carpools to pay for use of the lane during the period currently restricted to 3+ carpools. Two person carpools are charged \$2 per trip for the use of the lane. The advantage of using the HOT lane can be up to a 20 minute time savings. The project uses an Electronic Toll Collection (ETC) system.

11. Public and/or Institutional Issues

Institutional Issues

The Metropolitan Transit Authority of Harris County (Houston Metro) is responsible for operation and enforcement. TxDOT owns the right-of-way and is responsible for maintenance. Revenue collection and enforcement has sometimes been difficult due to the multiple entrance and exit points on the system.

Public Perception

As far as impacting congestion in general purpose lanes, "the QuickRide program probably has negligible impact" (D. Fink).

Government Perception

The mayor is pushing to expand the "QuickRide" program to all of the Houston metro area HOV lanes and to also begin selling excess capacity to SOV. Right now, the program is approximately breaking even financially.

12. Other

The Katy Freeway HOT lane is one of six operational HOV lanes in the Houston area (the others are I-45 North & South, US 59 North & 59 South, and US 290 West).

HOT Case Study

1. Project Name - I-394 MnPass



2. Managed Lane Strategy - Conversion of HOV to HOT

3. Contact - Daryl Taavola, Minnesota Department of Transportation (651) 282-2115
<http://www.dot.state.mn.us/information/hov/pdfs/hov-sec10.pdf>

4. Project Location - Minneapolis, Minnesota

5. Functional Class - Urban Freeway

6. Objectives - Improve HOV lane utilization by allowing SOV to use the facility with a toll

7. Capital costs - \$8-10 million

8. Start Date - 1985 for HOV, projected 2004/2005 conversion to HOT (MnPass)

9. a) Operating costs - (under negotiation)
b) Revenue - \$1-4 million (forecast)

10. Project Description

Minnesota has implemented its high occupancy toll lanes (MnPass) in May 2005. The system converted the I-394 HOV lanes into pay-per-use express lanes.

The 11-mile length of HOT lanes allows SOVs to take advantage of the excess capacity along the previously underutilized HOV lanes. These HOT lanes are unique in that they are the first HOT lanes in the U.S. implemented as non-barrier separated, diamond lanes. Barriers will remain in the present application along a three-mile stretch of the highway closest to downtown Minneapolis. This three-mile barrier separated segment operates as a two-lane reversible system. Double yellow lane striping was installed along the non-barrier segment to limit entrance and exit points for the express lanes. The goal is to maintain a premium level of service for all users of the express lanes by setting the price for SOV at levels that ensure free flow. HOT users are tracked using a transponder based system. Motorists will also notice an increase in law enforcement presence in the corridor. The fine for misusing the Express Lanes is \$130 and is a moving violation.

11. Public and/or Institutional Issues

Institutional Issues

The project was developed and completed through a public/private partnership involving the State of Minnesota and a service vendor. The private firm funded 25% of the project's estimated capital costs.

Public Perception

Public and media comment on the lanes has been generally positive. To facilitate public input into the design phase, an I-394 Express Lane Community Task Force was established, with representation from state and local elected officials, the Metro Council, citizens from local communities, and participation from transportation organizations such as AAA Minnesota, Downtown Minneapolis TMO, Minnesota Trucking Association, and Transit for Livable Communities.

12. Other

The MnPASS 394 Express Lanes will use a dynamic pricing system that adjusts the toll based on the speed and volume of traffic in the Express lane. Mn/DOT anticipates that the tolls should average \$1 to \$4 dollars during the busier parts of the day. Fees could reach as high as \$8 if traffic conditions warrant it. Carpoolers, motorcycles and buses can still use the lanes for free.

HOT Case Study

1. Project Name - SR-91 Express Lanes



2. Managed Lane Strategy - High Occupancy Toll (HOT) Lanes

3. Contact - Ellen Burton, Orange County Transportation Authority (714) 560-6282
<http://www.91expresslanes.com/>

4. Project Location - Orange County, CA

5. Functional Class - Urban Freeway

6. Objectives - Provide drivers with a shorter travel time for a fee

7. Capital costs - \$135 million

8. Start Date - 1995

9. a) Operating costs - \$27.6 million (2003)
b) Revenue - \$31.3 million (2003)

10. Project Description

The Route 91 Express Lanes was the nation's first project implementing the concept of value pricing. The Express Lanes were financed by a private firm. In 2003, the Orange County Transportation Authority purchased the HOT lanes and they currently are a public owned facility. Two toll lanes in each direction were built in the median of the existing eight-lane freeway. Toll rates vary by time of day to ensure that the Express Lanes remain un-congested at all times. As of April 2004 tolls varied between \$1.00 and \$6.50. To determine when toll adjustments are necessary, hourly traffic volumes in the lanes are monitored. As of May 19, 2003, 3+ carpools can drive the 91 Express Lanes for free. The only exception is during eastbound travel on weekdays from 4:00 - 6:00 PM, when 3+ carpools would pay the toll charge discounted by 50%. Vehicles with 1-2 passengers are required to pay the full toll price during any time of day. Violators can be fined up to \$500.

11. Public and/or Institutional Issues

Institutional Issues

All tolls are collected electronically and only vehicles with valid transponders are permitted to enter the Express Lanes. The facility is open to all vehicles carrying FasTrakTM transponders. Enforcement is done electronically, using photographic license recording methods as vehicles pass spotter booths located at the midpoint of the facility. On January 3, 2003, Orange County Transportation Authority (OCTA) officially assumed public ownership of the 91 Express Lanes from the private firm that had owned and operated it previously. The purchase was made to eliminate the non-compete agreement between the private and public agencies. Under the non-compete agreement, no parallel improvements could be made within 1.5 miles of the Expressway. The purchase price of the lanes was \$207.5 million. Public officials from Orange and Riverside Counties now manage the toll road.

Public Perception

Public approval of the variable tolls, while initially somewhat restrained, has increased significantly after two years of operation.

12. Other

FasTrakTM is accepted by other toll facilities in California.

Toll Facilities

Objectives - The primary purpose of tolls is to cover the cost of road construction. In some cases tolls are lifted once the tolled facility itself is paid for, while in other cases tolls are paid into a fund used to finance system operation and expansion.

In recent decades economists have increasingly called for tolls to be used for demand management, especially during periods of peak demand, as a separate objective.

Capital Costs - These can vary dramatically by the environmental conditions, such as grade separation, toll devices used, right-of-way needs, and/or costs for back office and customer support. Estimated Capital Costs: \$30 million per mile.

Operating and Maintenance Costs - Estimated Operation & Maintenance Costs: \$250,000 per mile.

History - Toll roads have a long history in the U.S. The first federally-sponsored road, the National Pike, was a toll road. In the 1800's, hundreds of toll roads were constructed in the U.S. by private companies; more than 150 were built in California alone. This industry eventually died out due to a combination of over-regulation and government subsidies to competing modes (rail and canals).



During the 1940's a second wave of toll roads began which included the Pennsylvania Turnpike, New York Thruway, Maine Turnpike, and Florida's Sunshine State Parkway. These roads were built by state agencies. This second wave was pre-empted in the 1950's by the Interstate Highway System, though 2,900 miles of toll roads were grand-fathered into the Interstate system (about 5 percent of the total).

The third wave of road tolling began when the interstate system ceased expansion and electronic toll collection technologies became inexpensive and reliable. The Dallas North Tollway was the first in the U.S. to use electronic tolling (1989) followed closely by the Oklahoma Turnpike (1990). ISTEA (1991) included funds for pilot projects that made it easier to experiment with creative types of tolling. In 1993, five tolling authorities (since expanded to include 16 states) on the east coast banded together to form the I-95 Corridor Coalition. They agreed to use mutually compatible electronic tags, more than four million of which are currently in use.

Institutional Issues - The key issue in the decision to put tolls on roads has always been the relative ease of collecting tolls, compared to collecting indirect taxes that could be used to fund roads. For example, in the early 1800's it was easier to collect tolls from slow moving horse-drawn vehicles on a sparse road network than it was to tax hay. By the 1950's vehicles were moving much faster. Stopping to pay tolls became more of a nuisance, and the road network became much more extensive. It was more practical to tax the relatively few gasoline distributors rather than erect hundreds of toll booths in every city. Toll collection continued where it was practical, such as for long bridges with few alternate routes. In the 1990's the situation reversed itself again with the introduction of electronic toll collection (ETC) technologies that take up little space and did not require vehicles to slow down. These systems are also cheaper to operate than manual systems, make fewer errors, and greatly reduce the incidence of employee theft. These advances have eliminated most technical problems, leaving political and institutional issues as the main constraints to wider use of tolling.

Toll facilities
are most often
put in place
to cover the
cost of road
construction

Congress is currently considering giving more tolling flexibility to states allowing added capacity to existing interstates using tolls.

Public Reaction - Public reaction to tolling has traditionally been negative, though this has changed in the last decade. The previous objections have centered on several issues:

- **The inconvenience of tollbooths:** This objection has declined over time in places with electronic tolling, but it persists in places with no experience with modern tolling.
- **Appearance of double-taxation:** There is almost always a negative reaction to tolls if the users feel that the road has already been paid for through taxes.
- **Resentment towards payments to the government of any kind:** Because they are obvious, tolls are more subject to this phenomenon than indirect taxation of gasoline.

Toll Authority - Since 1916, Title 23, Section 301 of the U.S. Code has prohibited tolls on federal-aid highways ("Except as provided in Section 129 of this title with respect to certain toll bridges and toll tunnels, all highways constructed under the provisions of this title shall be free from tolls of all kinds"). This prohibition carried over into the interstate highway program with few exceptions (federal aid is permitted for the construction of tolled bridges).



Electronic Tolling
in many places
has eased the
inconvenience of
tollbooths for
motorists


Since the early 1990's, Congress has been considering changing the law to permit greater use of tolling. ISTEA (1991) included five new exceptions to Section 301, and the Interstate Toll Pilot Program (1998) authorized up to three experiments with installing tolls on existing interstates in conjunction with needed reconstruction or rehabilitation.

- **Obvious and unique need:** If tolls will be used to fund projects that are both obviously needed and outside the routine duties of the DOT then they are more easily accepted. This includes highways and bridges that significantly shorten trips or bypass congestion.
- **Targeted towards outsiders:** Facilities that serve a high percentage of out-of-state or out-of-area users tend to be more easily accepted than roads used primarily by local residents. For example, in some states, toll facilities are only on roads serving beaches, ski areas, and other recreational sites.
- **Tax Aversion:** Many anti-tax groups see tolls as a user fee rather than a tax, and support tolling as an alternative to higher taxes.


The general experience has been that once non-coercive tolling (i.e., a non-tolled alternate route exists) has been introduced into an area, public acceptance tends to grow over time. This explains why toll advocates place so much importance on pilot projects and why toll opponents push for state-wide blanket prohibitions of tolling.

Environmental Issues - Environmental groups have been generally supportive of tolling when applied to existing facilities and generally opposed when applied to new facilities. This is because tolling of existing facilities will tend to decrease auto usage and its environmental effects, while tolling for new facilities will increase the viability of freeway expansion and thus undercut attempts to reduce auto dependency.


Other- Utah's neighboring states provide interesting examples of the institutional problems surrounding toll roads:




Colorado: Prior to the Federal Highway Act of 1916, Colorado had more than 300 miles of toll roads. After 1916 Colorado funded new road construction through federal funding and a gas tax, though some existing toll roads continue to operate. In 1987, the need to complete Denver's beltway aided passage of the Public Highway Authority Act, which enabled city and county governments to establish authorities to build toll roads. In 2002 another law was passed allowing the state DOT to put tolls on new state highways.




Arizona: The State of Arizona requires that toll roads be constructed by private companies, which are subject to a complicated and onerous privatization process. This has stymied attempts to build toll roads in Arizona. The state has received six proposals for privately funded tollways, ADOT is facing a \$9 billion shortfall in funding over the next decade and favors toll roads, and nearly 70 percent of surveyed residents are supportive of tolls used for project funding. Nevertheless, toll roads are likely to be stalled until either the privatization process is streamlined or ADOT is authorized to build toll roads itself.



Nevada: Nevada had an extensive system of toll roads in the 1800's which died out due to competition from railroads. Nevada eliminated its statutes on toll roads in 1989. NDOT's position is that because toll roads are not prohibited they are, by default, permitted. In fact, the state's only toll road (in the Valley of Fire Park) opened after the toll road statute was eliminated (1995). Legislation to replace the previous toll road statutes was presented in four successive legislative sessions and was approved by the transportation committees, but failed to pass. Literature suggests that legislative support for toll roads is low because they are viewed as double taxation (Nevada has the nation's highest combination of state and local gasoline taxes).



Idaho: Prior to 1881 more than half of the road-miles in Idaho were tolled. A law that year forbade the issuance of new toll road franchises and declared all roads free. Maintenance was to be provided by several days per year of forced labor by all male residents aged 21 to 50. This system proved impractical. Tolling resumed until legislation permitting private toll roads was repealed for a second time in 1929 and replaced with a gasoline tax. The licensing of toll roads was legalized for the third time in 1985, but apparently no license has yet been granted under this authority.



Wyoming: Wyoming does not currently have toll roads, and the state constitution forbids passing laws to grant charters or licenses to specific toll road companies. There is little pressure for toll roads in Wyoming, which has little traffic congestion and traditionally receives a generous portion of the federal gasoline tax revenue (Wyoming receives \$1.20 for every \$1.00 it pays into the system, compared to Utah's \$.90 on the dollar).

Toll Road Case Study

1. Project Name - San Joaquin Hills Toll Road



2. Managed Lane Strategy - Toll Road

3. Contact - Customer Service 1-800-378-8725, <http://www.thetollroads.com/home/index.htm>

4. Project Location - Orange County, CA

5. Functional Class - Urban Expressway

5. Objectives - Finance a new road and alleviate congestion

6. Capital costs - \$1.2 billion

7. Start Date - 1996

8. a) Operating & Maintenance - \$43 million
b) Total Revenue - \$73 million/year (2003)

9. Project Description

Studies conducted in the mid 1970's determined that the San Joaquin Hill corridor would be a critical new road to service Orange County's travel demands. The road was not initially planned to be a toll road. Because funding to build the road was scarce, toll roads began being considered in the early 1980's. San Joaquin Hill Corridor (State Route 73) was built as a 15-mile toll road connecting I-405 in Costa Mesa to I-15 south of Crown Valley Parkway in 1996. The toll road has 12 access points and one mainline toll plaza.

10. Public and/or Institutional Issues

Toll Authority

Two toll agencies, the Foothill/Eastern Transportation Corridor Agency and the San Joaquin Hills Transportation Corridor Agency, were founded in 1986. Although these two agencies are legally separate, the toll roads they operate have a consistent fee structure and enforcement policies. Collectively the two agencies are referred to as the Transportation Corridor Agencies (TCA). In 2004 these two agencies explored the possibility of formally combining into one legal toll authority. San Joaquin Hill Toll Road is currently run by the San Joaquin Hill Transportation Corridor Agency. In 1987, California Senate Bill 1413 gave the TCA power to issue bonds and use these bonds to finance toll facilities.

Public Perception

According to a 2001 Survey, 54% of Orange County residents think toll roads are good for Orange County and 12% think they are bad. 80% of residents drive to work alone and 60% consider traffic congestion to be a problem.

11. Other

Electronic Toll Collection (ETC) is available through the FasTrak™ System. The March 31, 2004 toll rate on the mainline during peak periods was \$3.50 for those paying with cash and \$3.00 for those paying with FasTrak™. Toll road rates vary by time of day and method of payment. Peak periods are Monday-Friday 7-9 AM and 4-7 PM. The FasTrak™ ETC system is also used by other toll roads in Orange County.



Toll Road Case Study	
1. Project Name - Alligator Alley (I-75, Everglades Parkway) 	
2. Managed Lane Strategy - Toll Road	
3. Contact - Christa Dismuke, Project Management FDOT, (850) 414-4652 http://www.dot.state.fl.us/financialplanning/finance/tfrtf/FDOT-Assisted-Toll-Facilities.pdf	
4. Project Location - Lee County, Florida	5. Functional Class - Rural highway
6. Objectives - Provide a direct link between the Atlantic and Gulf Coasts of Florida	7. Capital costs - \$17 million
8. Start Date - 1966	9. a) Operating & Maintenance - \$4.9 million b) Total Revenue - \$13 million/year (2003)
10. Project Description Southern Florida has high population density on its Atlantic and Gulf Coasts. A large portion of central southern Florida is covered by the Everglades. Alligator Alley (Everglade Parkway) is a four lane toll road running east-west between Naples and Ft. Lauderdale, Florida. The 78-mile road runs through the Everglades and the Miccosuckee Indian Reservation. There are relatively few access points between the two metropolitan ends of the freeway. Electronic Toll Collection service is available through the SunPass System. In 1999 Alligator Alley began collecting fares in only one direction. One-way toll collection reduces vehicle delays and improves air quality, because vehicles are only required to stop once for toll collection. The toll for passenger cars is currently \$1.50.	
11. Public and/or Institutional Issues Toll Authority The toll road is operated by the Florida Department of Transportation (FDOT). Bonds were issued in 1997 (\$55.2 million) for SunPass installation, toll plaza, and rest area reconstruction. As of June 2003 the outstanding bond debt was \$49.9 million. Public Reaction Controversy over the construction of Alligator Alley was mainly related to economics and safety. Dade County was afraid of losing business due to the new route and drivers were hostile to the toll. There were concerns that head on collisions would be frequent on the long two lane road. Today the road is generally accepted by the public. Truckers frequently use the road, giving it the highest percentage of truck traffic on a toll road in Florida. Environmental Impacts Construction of Alligator Alley contributed to water flow alterations and other ecological impacts on Everglades National Park. Approximately \$2 million from Alligator Alley revenues is transferred annually to the Everglades Fund for environmental improvements.	
12. Other The SunPass is accepted on all major roadway and bridge toll facilities in Florida. U.S. 41 is the only other major east-west road across southern Florida. It may be taken to avoid the toll road, but this route is less direct than Alligator Alley.	

Toll Road Case Study

1. Project Name - E-470



2. Managed Lane Strategy - Toll Road

3. Contact - Jo Snell, E-470 Public Relations Manager (303) 537-3734, <http://e-470.com>

4. Project Location - Denver, Colorado

5. Functional Class - Urban Freeway

6. Objectives - Build a new road in the absence of federal or state funds

7. Capital costs - \$1.2 billion (includes construction, right-of-way, financing-related costs, and contingencies over 12 years)

8. Start Date - 1991

9. a) Operating & Maintenance - \$16 million
b) Revenue - \$54.6 million/year (2002)

10. Project Description

In 1982, Arapahoe County, Douglas County, Greenwood Village and private developers published the Centennial Airport Influence Area Study, recommending that C-470 be extended east and north. In the absence of state and federal money, the E-470 commission was formed in 1985. This group lobbied until the Colorado Senate enacted legislation in 1987 that allowed the group to plan, design, finance, and operate E-470. E-470 is a 46-mile toll expressway that runs along Denver's eastern perimeter. The cross section ranges between four and six lanes. The beltway runs between State Highway C-470 at I-25 in Douglas County to I-25 south of 160th Avenue. The first section of the toll road from I-25 south to Parker Road was opened in 1991. Additional sections of the expressway were opened in 1998 and 1999. In 2003 the final section of the road from 120th Avenue to I-25 north was opened. There are five mainline toll plazas and 17 toll stations on ramps entering the expressway.

11. Public and/or Institutional Issues

Toll Authority

E-470 is governed by the E-470 Public Toll Authority, which is comprised of eight member jurisdictions, four non-voting cities, and three Ex-officio members. The eight member jurisdictions are Adams, Arapahoe, and Douglas counties and the cities of Aurora, Brighton, Commerce City, Thornton, and the town of Parker. The non-voting cities include Arvada, Broomfield, Greeley, and Weld County. The Ex-officio members are the Colorado Department of Transportation (CDOT), Denver Regional Council of Governments (DRCOG), and the Regional Transportation District (RTD). The highway was financed using bonds and the planned year of total bond debt repayment is 2035. After revenues from E-470 have established a perpetual maintenance fund, the road will be turned over to CDOT and tolls will no longer be collected.

Public Reaction

At first, many drivers were not in favor of the toll expressway. A large public relations campaign attempted to inform the public on toll road financing and other key issues. However, the toll authority continues to receive email complaints about paying tolls on E-470.


Environmental Impacts

The E-470 Public Toll Authority has allocated up to \$1 million per year to providing environmental mitigations. The discovery of a golden eagle's breeding nest and historic areas of significance changed proposed alignments and configurations of E-470.

12. Other

Electronic Toll Collection (ETC) is available through the EXPressToll™ System. Tolls vary based on the distance traveled. The toll rate from I-25 N to I-25 S on E-470 (46 miles) was \$8.50 (March 2004).



Toll Road Case Study	
1. Project Name - JFK Memorial Highway (I-95) 	
2. Managed Lane Strategy - Toll Road	
3. Contact - MTA, Office of Median & Customer Relations, 1-866-713-1596 www.mdt.state.md.us/mta/Documents/jfk.pdf	
4. Project Location - Northern Maryland	5. Functional Class - Urban Freeway
6. Objectives - Accelerate highway construction by utilizing non-traditional funding	7. Capital costs - \$73 million
8. Start Date - November 1963	9. a) Operating & Maintenance - \$16.9 million b) Total Revenue - \$75.2 million/year (2003)
10. Project Description The fifty-mile-long Northeastern Highway was completed in 1963 and renamed the John F. Kennedy Memorial Highway in 1964. The highway is currently six lanes, expanding to eight lanes in some sections (three - four lanes per direction). The highway runs from I-95 in northern Baltimore to the Delaware border. In 1991, the highway began operating as a one-way-toll-collection system in the northbound direction. Toll rates were increased in 1991, to reflect that drivers were now purchasing a two-way ticket at one toll facility. The highway's two toll plazas are located 15 miles apart. These toll plazas feature tourist information, automotive centers, and consumer conveniences. Electronic toll collection is available for frequent users.	
11. Public and/or Institutional Issues The Maryland Transportation Authority (MTA) is responsible for Maryland's seven toll facilities. The Governor appoints six people to the Transportation Authority with the consent of the State Senate. Each of the six members of the Transportation Authority serve three years with two positions expiring each year. The highway was financed using bonds. Revenues generated by the facility are first allocated towards repaying the bond-debt, and then towards improving and maintaining the road facility. The road was developed as an interstate toll facility because traditional funding measures would have caused the highway to be built seven years later than planned.	
12. Other Tolls may be collected electronically through the Maryland-issued E-ZPass SM System. Toll discounts are also available through the E-ZPass SM . The following are toll rates as of March 2004 (tolls only collected in one direction): 2 axles: \$5, 3 axels: \$10, 4 axels: \$15, 5 axels: \$20, 6 axels: \$25. Annual bi-directional traffic on JFK Memorial Highway is approximately 29 million vehicles. The E-ZPass SM is accepted throughout the Northeast.	

Toll Road Case Study

1. Project Name - Chicago Skyway



2. Managed Lane Strategy - Toll Road

3. Contact - Brian Steele, (312) 744-0707, <http://www.cityofchicago.org/Skyway/>

4. Project Location - Chicago, IL

5. Functional Class - Urban Expressway Bridge

5. Objectives - Provide a direct route from northern Indiana to Chicago

6. Capital costs - \$101 million

7. Start Date - 1959

8. a) Operating costs - \$10 million
b) Revenue - \$43 million/year (2002)

9. Project Description

In the mid 1950's the City of Chicago planned to build a toll road to connect northwest Indiana to Chicago. In the process the city discovered that it lacked the authority to build a toll road. However, the City did have the power to build a toll bridge. Thus, the City of Chicago began constructing the lengthy toll bridge over the Calumet River. The Skyway is a six-lane toll bridge 7.8 miles in length. The median divided toll road connects the I-90 Indiana Toll Road to the Dan Ryan Expressway (I-94) in Chicago. In its first year of operation, the Skyway produced \$1.5 million in revenue (only 1/3 of the projected revenue). Bondholders took the city to court several times between 1970 and 1990 because of missed payments. Suits alleging Skyway employee theft also cost the City of Chicago \$13 million between 1970 and 1980. The opening of casinos in northwest Indiana and increased congestion on the expressway system in the late 1990's has improved the profitability of the Skyway in recent years. The Skyway is currently undergoing a \$300 million Capital Improvement Program (CIP), to be finished by 2005.

10. Public and/or Institutional Issues

Public Perception

Daily commuters comprise 38% of Skyway traffic. Passenger cars constitute 90% of Skyway traffic. The alternate routes to and from Indiana are longer and carry a high percentage of trucks. The Borman Expressway, one alternate route, carries approximately 40,000 trucks each day, making it the fifth busiest truck highway in the U.S. Toll rates on the Skyway have not increased in over 10 years, improving driver willingness to pay the toll. Skyway patrons are choice drivers.

Institutional Issues

The Chicago Skyway is maintained by the City of Chicago Department of Transportation. In the spring of 2004, the City offered a long term concession agreement to experienced private toll operators. The private toll operator would take over toll collections and toll bridge maintenance. The deadline for prospective buyers was April 24, 2004.

11. Other

As of March 2004, the Skyway does not have an Electronic Toll Collection (ETC) system. Toll rate for two-axle passenger cars was increased from \$1.75 to \$2.00 in 1993. It has remained at \$2.00 since 1993. Tolls are collected in both directions of traffic.

Cordon Pricing

Objectives - Cordon pricing was originally proposed by economists, not engineers, as a way to promote more efficient use of road space. This was the objective of the first large-scale application of cordon pricing (Singapore, 1975). It has remained an important secondary objective in all subsequent applications; however, it has not been the most important objective for any place other than Singapore.

The most common primary objective is to reduce traffic demand in places where continued provision of additional capacity seems untenable in the long term. Most applications have been in dense downtown areas where new roads could not be built without acquiring substantial rights-of-way that would destroy much of the city they are intended to serve.

In some cases the primary objective was to raise funds for transportation improvements in tax-averse environments. In such cases cordon pricing is bundled with the projects it is intended to fund and proposed as a single package.

Cordon pricing has also been used (Durham, UK) and proposed (Rome, Italy) as a way to reduce traffic near world heritage sites.

Capital Costs - These can vary dramatically by the environmental conditions, such as number of entrance points, toll devices used, right-of-way needs, and/or costs for back office and customer support. Estimated Capital Costs: \$220 million.

Operating and Maintenance Costs - Estimated Operation and Maintenance Costs: \$15 million.

Start Date -

- Singapore - 1975
- Bergen 1986
- Oslo -1990
- Trondheim - 1991
- London - 2003

Cordon charges vary widely depending on their purpose. Most are in the \$1-\$4 range, though London charges \$9. Operating and maintenance costs are typically in the range of 10 to 20 percent of revenues.

Project Location - This strategy has been used for over twenty-five years in parts of Europe and Asia. Cities that have used this strategy range in size from Namos, Norway (population 12,000) to London, England (population 7 million).

Large Cities (>2M): Singapore, London

Medium Cities (100,000 to 2M): (in Norway) Bergen, Oslo, Trondheim, Stravanger (in UK) Durham

Small Cities (<100,000): (in Norway) Kristiansand, Namos

Institutional Issues - The chief issue is that cordon pricing is imposing a fee on a service that had previously been offered for free. As with the withdrawal of any subsidy, cordon pricing will be resisted by the former beneficiaries unless they are convinced that the alternative (intolerable congestion or some alternative form of taxation) will be worse.

Technical issues are not important in cordon pricing; it can be effectively implemented using existing technologies.

Toll Authority - Few jurisdictions have the authority to charge fees for the use of specific, previously-free public roads. Special legislation granting such authority is needed. In London, for example, a new law was passed in 1999 giving future mayors the authority to use congestion charges. The following year a new mayor was elected who made immediate use of this authority.

Public Reaction - Public perception of cordon pricing tends to be very negative prior to implementation and generally positive afterwards. In Trondheim, 72 percent opposed cordon pricing a year prior to implementation compared to only 36 percent a year after implementation. This was because critics were able to convince the public that cordon pricing was unworkable, would result in chaos, would overload alternate routes, affect business, etc. When these problems failed to materialize the public became more focused on the advantages of the system.



Public reaction
tends to improve
after cordon pricing
implementation

Studies of successful and unsuccessful cordon pricing projects have concluded that there are two critical factors to success: 1) it must have a strong champion who is able to carry the project through the unpopular pre-implementation phase and into implementation; and 2) the project needs to be bundled with other more popular measures that will make use of the revenues raised.

Bundling is especially important in gaining the support of lower-income residents. Prior to implementation, newspaper columnists and politicians sometimes oppose cordon pricing because of its effect on the poor. Post-implementation surveys, however, find widespread support among lower-income groups for cordon pricing if the revenues are used to improve transit services.

Environmental Issues - In the short term, cordon pricing has the positive impacts of reducing regional vehicle trips and vehicle miles traveled. In the longer term it may reduce pressures to expand the road network.

Other - Some of the advantages of cordon pricing can be achieved through partial systems. New York City, for example, uses bridge and tunnel tolls to reduce the demand for auto travel across certain screenlines. This system is more like cordon pricing than conventional bridge tolling in that the tolls are the same at every point on the line and they are not related to the cost of the tolled facility.

The system is only partial because a 1910 law prohibits tolling of bridges already constructed at that time, six of which are still in use.

Cordon Pricing Case Study

1. Project Name - Lee County Cordon Pricing



2. Managed Lane Strategy - Cordon Pricing

3. Contact - Margie Byers, CRSPE Inc., (239) 573-7960 <http://www.fmbtrafficsolutions.org/>

4. Project Location - Ft. Myers Beach, FL

5. Functional Class - NA

6. Objectives - Alleviate congestion

7. Capital costs - NA

8. Start Date - Currently under study

9. Operating costs - NA
Revenue - \$1.2 - 4.1 million/year (projected)

10. Project Description

The island town of Ft. Myers Beach became a municipality in 1995. There are 6,100 year round residents and thousands of tourists who visit the town each month, especially during the winter. The limited land on the island makes building additional roads difficult. The town encourages tourism, but would prefer that tourists leave their cars on the mainland and take buses or other high occupancy modes into town (2002 study). In 2001 and 2002 FHWA granted Ft. Myers Beach \$545,600 and \$500,000 respectively to study the possibility of implementing cordon pricing. By tolling the two major bridges accessing the island, the town would capture the majority of traffic entering the island community.

11. Public and/or Institutional Issues

Public Perspective

Ft. Myers has a significant retirement community living on fixed (although generally high) incomes. A vocal group within the retirement community strongly opposes tolling as a solution to traffic congestion. This group actively attends city council meetings, has written letters to the FHWA requesting the cancellation of the cordon pricing study grant, and created such heated discussions that police had to break up one city council meeting.

Government Perspective

Five city council members are elected to make decisions regarding the cordon pricing alternative. The local government was initially in favor of the cordon pricing alternative. Since the initiation of the study, three city council members have been elected on "anti-toll" platforms. As of April 2004 two council members supported the toll and three council members opposed the toll. It is likely that cordon pricing will not be implemented at this time in Ft. Myers Beach.

12. Other

If the cordon pricing tolls are not implemented, a parking fee alternative is also currently being studied for the purpose of alleviating congestion.

Cordon Pricing Case Study

1. Project Name - London Cordon Pricing



2. Managed Lane Strategy - Cordon Pricing

3. Contact - For additional information see www.tfl.gov.uk/tfl/cc_london/cc_monitoring.shtml or <http://www.vtpi.org/london.pdf>

4. Project Location - London, England

5. Functional Class - NA

6. Objectives - Alleviate congestion

7. Capital costs - £180 million [\$220 million]

8. Start Date - 2003

9. Operating costs - £64 million [\$115 mil]
Revenue - £100 mil [\$180 projected] (2003)

10. Project Description

In 2000, the political structure of London changed and elected mayors were granted the power to raise taxes for the purpose of funding transportation improvements. Ken Livingston won the mayoral election with a platform to implement congestion pricing. This plan was criticized by certain special interest groups; however, in February of 2003 the City of London began charging fees to enter the central area during weekdays. The toll for entering the central area between 7:30 AM and 6:30 PM is £5 [\$9]. Net revenue from the cordon pricing program will be used to improve public transit service. These transit improvements include major renovation of the city's subway system and improved bus service. Currently drivers are charged a flat fee for entering the zone. In the future, however, the city will likely vary the toll by time of day, congestion levels, and/or vehicle miles traveled. The result of cordon pricing has been a 15% reduction in traffic volumes and a 30% reduction in vehicle delays as of March 2004. Prior to congestion pricing, 12% of the trips made in the downtown area were by automobile. A year later, automobile traffic comprised only 10% of traffic. Because of the reduction in traffic, the city has collected less revenue than initially projected (see revenue above). The system is enforced by using a network of video cameras that capture license plate images. "Optical character recognition" technology then matches the license plate with paid customers. If the customer has not prepaid, they receive a fine.

11. Public and/or Institutional Issues

Business Perspective

A late 2003 Transportation for London (TfL) survey indicated that 60% of London businesses support congestion pricing as long as there is continued improvement of transportation facilities. Only 12% reported business losses associated with congestion pricing and 65% reported that congestion pricing had no real impact on business. An earlier 2003 study showed less favorable results.

Public Perspective

There is some concern that the video camera enforcement will result in a loss of privacy. The government will combat privacy concerns by restricting access to video images. There is also some concern that the system is unfair to low-income workers who need a car for their employment.

Government Perspective

Congestion pricing is managed by permanent Transportation for London (TfL) staff, in conjunction with private contractors. TfL and the mayor have committed to a five year comprehensive monitoring of the program (public surveys, business surveys, traffic monitoring, etc.) to determine the impacts of, and possible improvements to, the congestion pricing program.

12. Other

Other European cities currently showing interest in cordon pricing include Stockholm, Barcelona, Milan, Edinburgh, and Cardiff.

Study team
members visited
managed lanes
facilities in
California, Texas,
and Colorado

3.4 Scan Tour

As part of the national program review, the study team visited existing managed lanes facilities in California, Texas, and Colorado. Members of the study team discussed managed lanes concerns on-site with representatives from the California Department of Transportation (Caltrans), San Diego Association of Governments (SANDAG), the Texas Transportation Institute (TTI), the Texas Department of Transportation (TxDOT), the Colorado Department of Transportation (CDOT), the Colorado Tolling Enterprise (CTE), as well as representatives from transit and other agencies.



The tour of existing western United States managed lane facilities gave UDOT an inside look at the technical, institutional, and social issues associated with managed lane development and implementation. This tour also established and strengthened relationships between UDOT and neighboring transportation organizations. Communicating with other organizations will help the State of Utah pursue appropriate and effective managed lanes strategies.

The following overall messages were gained from the scan tour:

- **Choice in Transportation** - One major benefit of managed lanes is choice in transportation. Congested, unreliable highway travel is becoming the only option for many highway travelers. Managed lanes offer drivers the choice of a non-congested trip for a price. This price may be behavioral (such as changing to carpooling) or financial. Drivers may still use the general purpose lanes “for free”, but managed lanes provide individuals with another option.
- **Interagency Collaboration** - Private automobile drivers are not the only people to benefit from managed lanes. Managed lanes are more effective when many agencies are involved in the development process. Transit can greatly increase the person thru-put of a managed lane, and managed lanes in turn provide transit with a quick and reliable service. Interagency collaboration between highway, transit, and enforcement is an important part of the success of managed lanes projects. Information/research sharing between agencies should also be part of the development process.
- **Public Support** - Managed lanes will not succeed because of traffic advantages alone. The public must first have the desire and means to use them. Public resistance is common in the first phases of managed lanes initiation. The vast majority of roads in the United States are built through indirect taxation, and drivers generally oppose paying for something that was previously “free”. There are public involvement efforts required to educate travelers how to use the new and sometimes unfamiliar facilities. All these obstacles must be overcome for managed lanes to succeed.

- **Managed Lanes Champion** - As previously mentioned, managed lanes are often not well received initially. To overcome initial opposition, a managed lanes project needs a champion. This champion must be willing to continue promoting the project in spite of significant opposition. Public favor often comes after the project is built and travelers experience the advantages.

Specific examples of managed lanes projects from the scan tour are listed below.



San Diego: Southern California has lead the nation in several managed lanes projects. SR-91 in Orange County was the nation's first project implementing the concept of variable pricing. The I-15 HOT lanes have also set a national precedent. The San Diego area experiences some of the worst congestion in the country, with 270 thousand vehicles traveling on I-15 during the average weekday. The HOT lanes on I-15 evolved from the existing HOV lanes, with the primary goal of congestion relief. The success of this project is due to the tremendous growth in use of the HOV lanes. Transit has also helped with HOT lanes utilization.



Houston: Houston is also leading the country in managed lanes implementation. The city currently has HOV lanes on six major freeway corridors. Two of these facilities (I-10 and US 290) raise the occupancy requirement from two-plus to three-plus occupants per vehicle during peak periods of the day. The QuickRide program allows vehicles with less than three passengers to use these HOV lanes for a fee. Providing drivers with an alternative transportation choice is one of the goals of Houston's managed lanes. The ability to generate revenue was also an important part of the decision to implement the HOT lanes. Harris County has an extensive traffic operations center where the managed lanes are monitored and enforced.



Providing drivers with transportation alternatives is one of the goals of Houston's managed lanes



Denver: The Colorado Department of Transportation is currently conducting a statewide tolling study. Specifically, the Colorado Tolling Enterprise (CTE) was organized by the state legislature, as part of CDOT, to manage and identify potential toll facilities. Projects that have received additional study include I-25 HOT lanes and C-470 express lanes. Local and federal agencies have been involved with CDOT throughout this process. A toll road currently exists on E-470 in Denver. This road was created by private developers and local communities. Special legislation (1987) was passed to allow the financing and construction of this facility. More recent legislation (2002) has granted CDOT, through the CTE, power to establish tollways.



Chapter 4 - Statewide Corridor Selection

4.1 Statewide Plan Goal

This study proposes a preliminary managed lanes system for the State of Utah and provides UDOT direction for additional analysis. The selection process for this system and the expected performance of each selected corridor are presented in the following sections.

4.2 Sketch Planning Methodology

A sketch planning approach was developed to guide the process of identifying the corridors that should be recommended for a managed lanes strategy (see Figure 4.1 - Managed Lanes Selection & Screening Methodology). This framework was developed after a thorough review of the managed lane methodologies employed by other states and a study of recent research. Although the screening process draws heavily on “what has worked” in other states (i.e., Texas, California, Colorado), it recognizes the distinct transportation needs of Utah. Ideas and concepts were selectively borrowed from other states while considering the conditions existing in this state.

The sketch planning methodology used for this study involved a three phase approach, moving from broad criteria to specific performance measures. Each successive screening layer (described in greater detail below) applied increasingly more rigorous criteria and analytical methods to the candidate corridors. For example, the initial screening involved relatively little data collection or quantitative analysis and was essentially a qualitative assessment. Whereas, the final screening of the few remaining corridors involved extensive use of the regional travel demand model and existing traffic data. The process was designed to function within the data constraints.

The resulting scope of each screening layer is outlined as follows:

- **Phase I** – Entire Utah state highway system
- **Phase II** – 50 initial candidate corridors
- **Phase III** – 14 candidate corridors remain
- **Conclusion** – Four corridors with high managed lanes potential



The Managed Lanes Study involved discussions with the project team

4.3 Phase I Screening

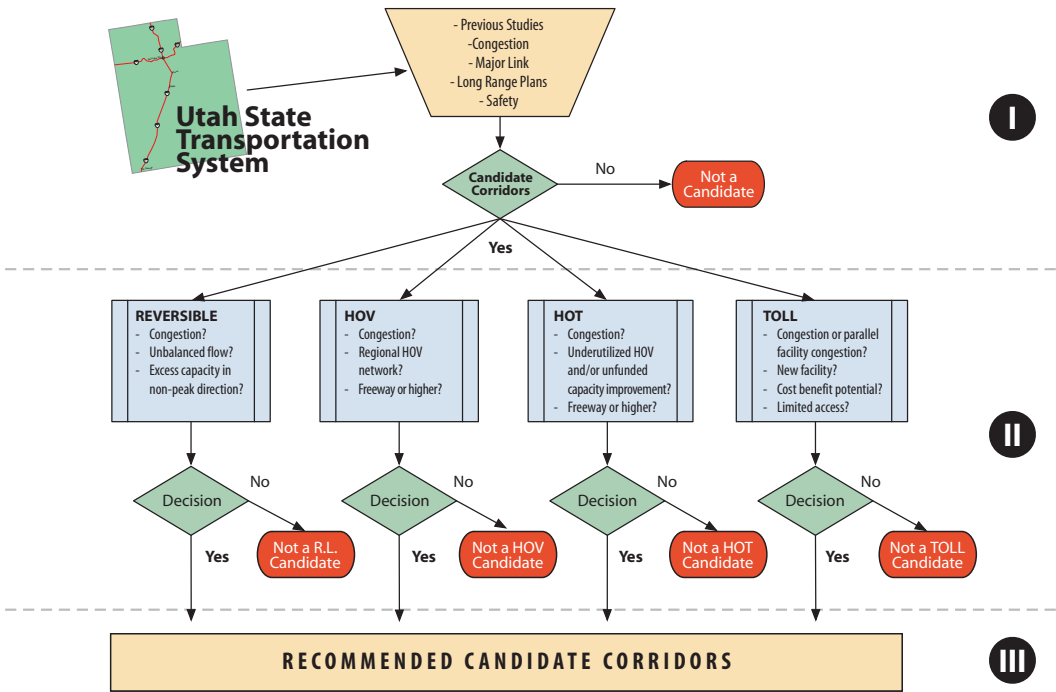
The Phase I preliminary screening process required potential corridors to meet at least two of the following criteria:

1. Previous studies of the corridor suggested a managed lanes strategy would be viable.
2. The corridor is a Long Range Transportation Plan capacity improvement project.
3. The corridor has current or predicted congestion.
4. The corridor has significant truck traffic or safety issues.
5. The corridor is a key link for region wide travel.

Approximately 50 potential corridors were selected from Utah's state transportation system using the Phase I screening process. The resulting Phase II corridors are presented in Figures 4.2, 4.3, 4.4, and 4.5.

Fig.4.1

MANAGED LANES SELECTION
AND SCREENING
METHODOLOGY



REGION 1 POTENTIAL CORRIDORS PHASE II

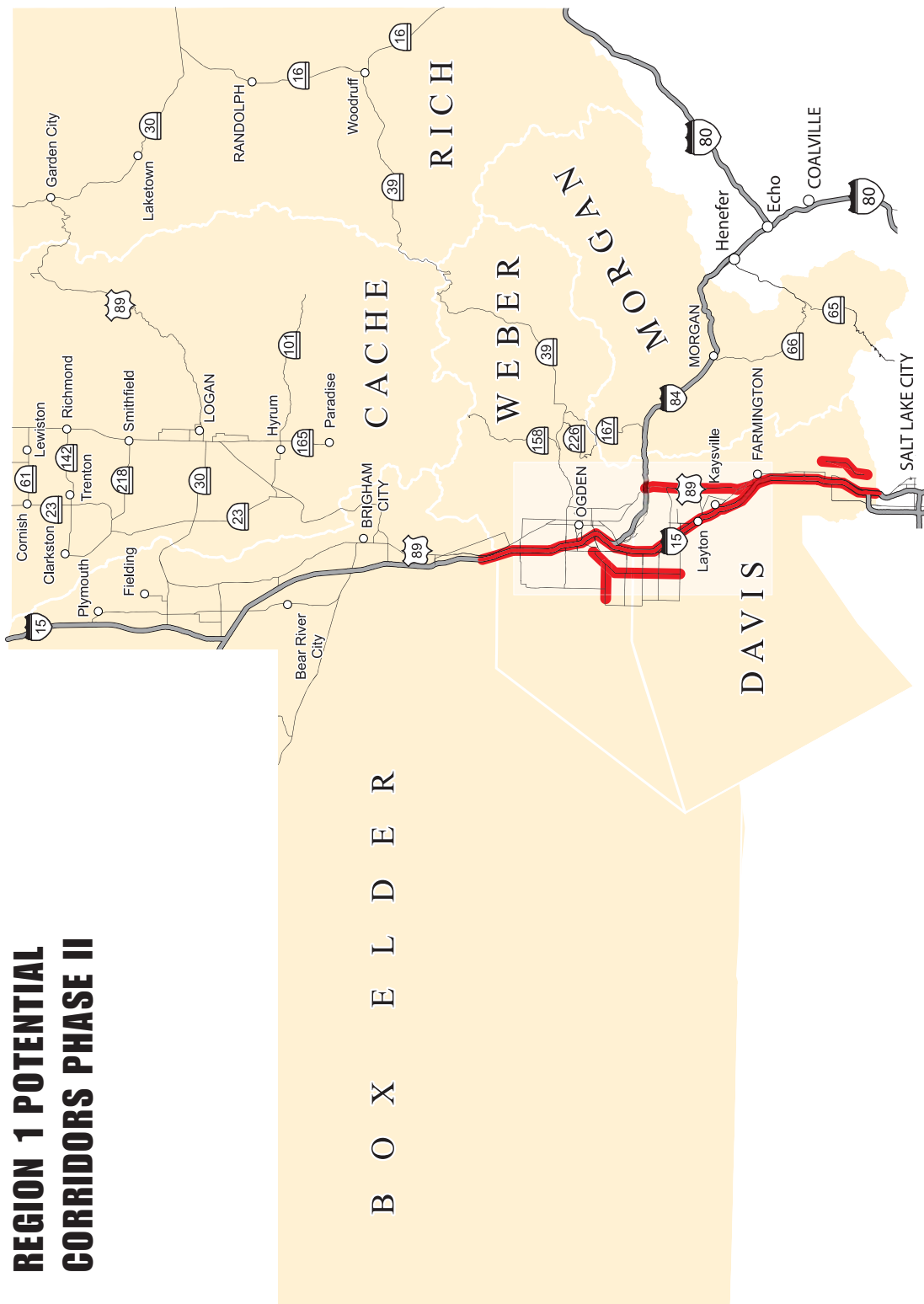
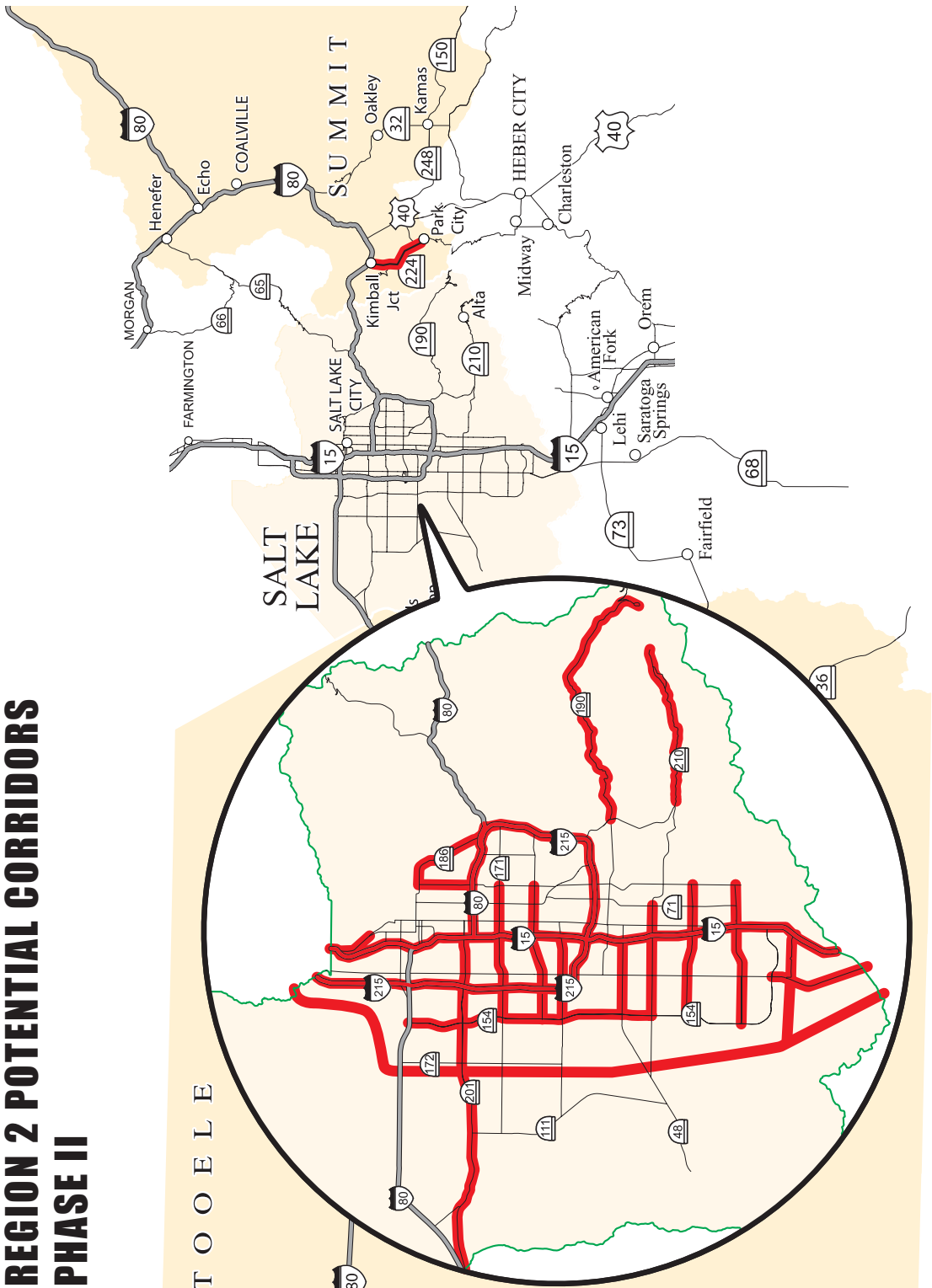


Fig.4.2

Fig.4.3

**REGION 2 POTENTIAL CORRIDORS
PHASE II**



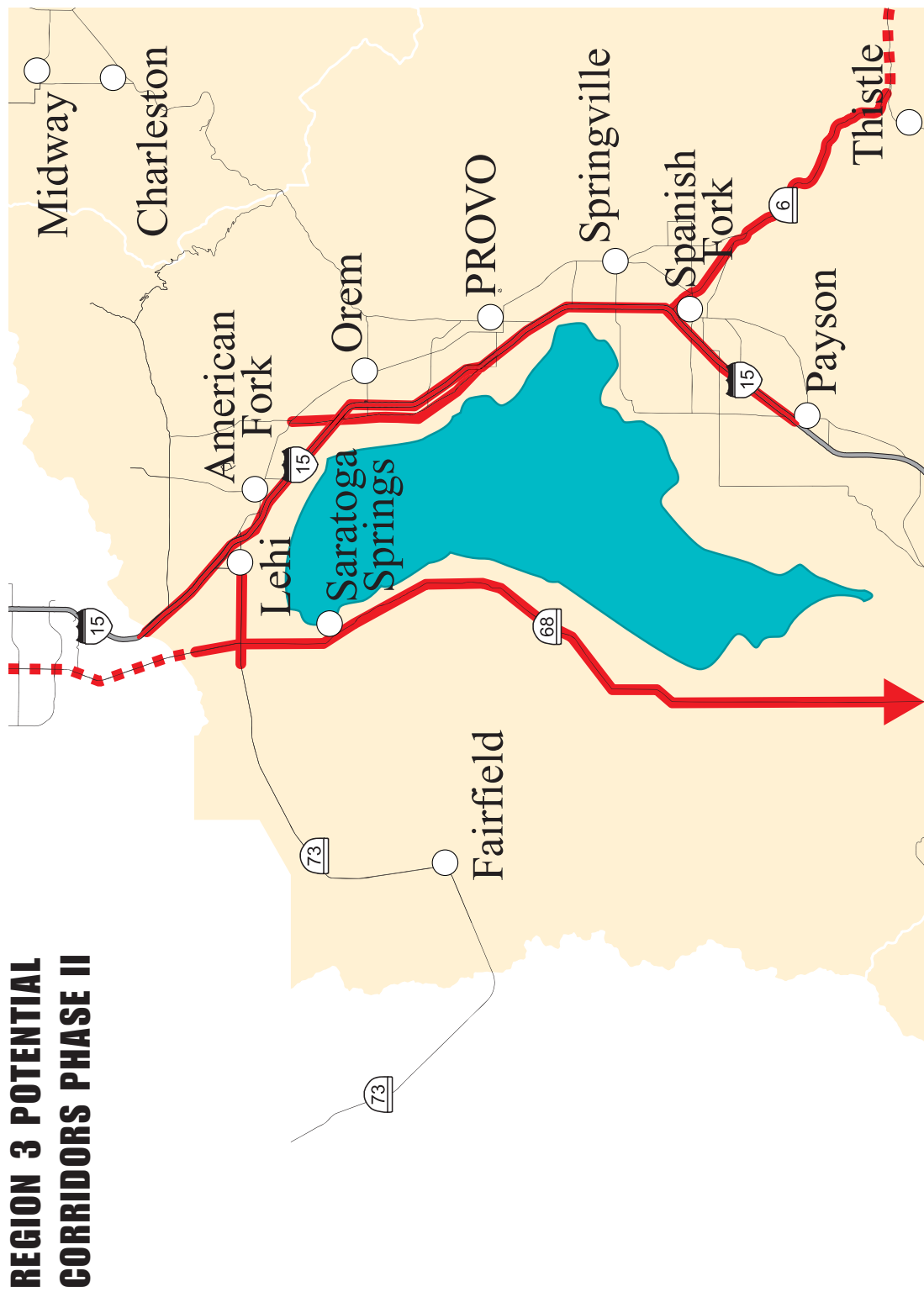
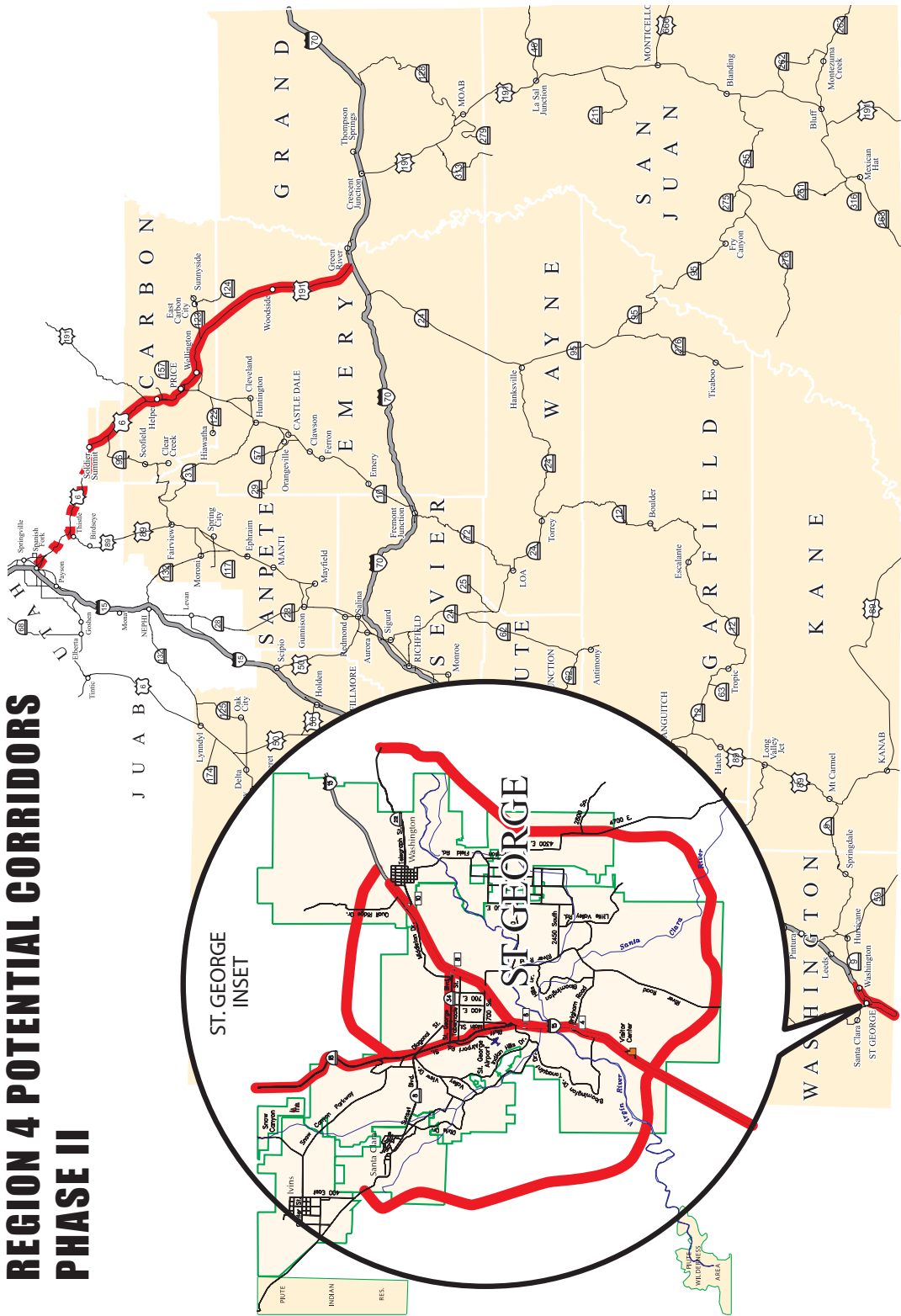


Fig.4.4

Fig.4.5

REGION 4 POTENTIAL CORRIDORS
PHASE II



4.4 Phase II Screening

Data

The first stage of Phase II screening consisted of an extensive data collection effort. Twenty-four hour traffic counts were analyzed for each corridor for which data was available, and daily traffic volumes were determined from UDOT's Traffic on Utah Highways 2002. A straight line forecasting process was used for facilities without available travel demand model data.

The following information was reported for the 50 Phase II corridors (present and future, when available):

- Area type
- Number of lanes
- Daily volume
- Daily level of service (LOS)
- PM peak period V/C
- PM peak period directional split
- Crash rates and expected rates (existing only)
- Major generators (if any)
- Facility type
- Daily capacity
- Daily volume to capacity ratio (V/C)
- PM peak (3-hour) period volume
- PM peak period LOS
- Percent trucks (existing only)
- Planned improvements (and source)

Screening Process

The Phase II screening process evaluated each corridor against fundamental managed lanes criteria. The purpose of this screening process was to match the potential corridors to the appropriate managed lanes strategies (i.e., reversible lanes, HOV lanes, HOT lanes, or Toll). Furthermore, a project could be recommended for more than one strategy. For example, several corridors passed the screening criteria for both the HOV and HOT strategies.

The Phase II screening process involved both quantitative and qualitative analysis. The quantitative analysis relied heavily on the numeric data obtained from traffic counts and other sources. The qualitative analysis considered factors such as facility type and regional continuity. A corridor selected on either the qualitative or quantitative analysis was "promoted" to Phase III.

Qualitative Criteria – In addition to the quantitative criteria, the qualitative measures concentrated on system continuity issues. Qualitative criteria addressed common sense issues such as those listed below.

- Are there any obvious gaps from a system wide perspective?
- Are there any additional corridors with safety concerns that would benefit from a managed lanes treatment?
- Could any additional corridors significantly enhance the benefits provided by the managed lane system?

These questions were answered collectively by the managed lanes team.

Quantitative Criteria – The following quantitative selection criteria were used during the Phase II screening process for the managed lanes project. A candidate corridor was required to pass all of the criteria for a managed lane strategy (Reversible Lanes, HOV, HOT, Toll) to be advanced.

Criteria – Reversible Lanes

- **Congestion** – The corridor must experience a volume to capacity (V/C) ratio greater than 0.90 during the PM Peak Period in the Base and/or Future year scenario(s). The Future year V/C ratio was calculated including Long Range Plan (LRP) capacity improvements.
- **Unbalanced Flow during Peak Period** – Corridors with directional splits of 60/40 or greater during the PM Peak Period were carried forward. (AASHTO recommends a 65/35 or greater traffic volume split for reversible lanes, but this planning level study chose a slightly more relaxed standard).
- **Capacity in Non-Peak Direction** – A corridor must have at least three lanes (both directions).

High Occupancy Vehicles Lanes

- **Congestion** – The corridor must experience a V/C ratio greater than 0.90 during the PM Peak Period in the Base and/or Future year scenario(s).
- **Part of Regional HOV Network and/or Arterial BRT Network** – The corridor should either be a logical extension to any existing regional HOV system and/or be designated in the respective LRP as a proposed HOV or BRT facility.
- **Freeway or Higher Facility Type** – The corridor is an expressway or freeway.

*The congestion
in the corridors
was evaluated
as part of
the Phase II
screening process*



High Occupancy Toll Lanes

- **Congestion** – The corridor must experience a V/C ratio greater than 0.90 during the PM Peak Period in the Base and/or Future year scenario(s).
- **Underutilized HOV and/or Unfunded Capacity Improvement** – This test is satisfied if either of the following criteria are met:
 1. For UDOT Region 2, the corridor is the I-15 HOV lane (a 2004 University of Utah report documents an average of 675 vehicles per hour use the HOV lane during the PM Peak period. The HCM 2000 indicates that the HOV lane could service 1680 vehicles per hour while maintaining LOS C).
 2. The corridor meets all of the above criteria for an HOV lane and has been recommended for capacity improvements in the respective LRP, but there is an absence of dedicated funding for these capacity improvements.
- **Freeway or Higher Facility Type** – The corridor is an expressway or freeway.

Toll Facilities

- **New Facility or New Lanes** – The proposed corridor must be either a new facility or new lanes added to an existing facility.
- **Congestion or Parallel Facility Congestion** – This test is satisfied if either of the following criteria are met:
 - The corridor must experience a V/C ratio greater than 0.90 during the PM Peak Period in the Base and/or Future year scenario(s).
 - The parallel traffic routes (that would provide an alternative to the toll road) experience congestion in the Base and/or Future year scenario(s).
- **Cost / Benefit Potential** – The corridor must connect two or more major trip generators (such as a recreation area, a major employment area, a major residential area, etc.).
- **Limited Access** – The proposed corridor must be a limited access facility.
- **Unfunded Capacity Improvement** – The corridor meets all of the above criteria for a toll facility and has been recommended for capacity improvements in the respective LRP, but there is an absence of dedicated funding for these capacity improvements.



Proposed toll corridors must be a new facility

4.5 Phase III Corridors

Based on the above criteria, 14 corridors advanced to Phase III. A more detailed analysis was conducted for these 14 corridors, including estimation of capital costs, operating costs, maintenance costs, and revenue. Figure 4.6 displays the Phase III corridors and their potential strategies.

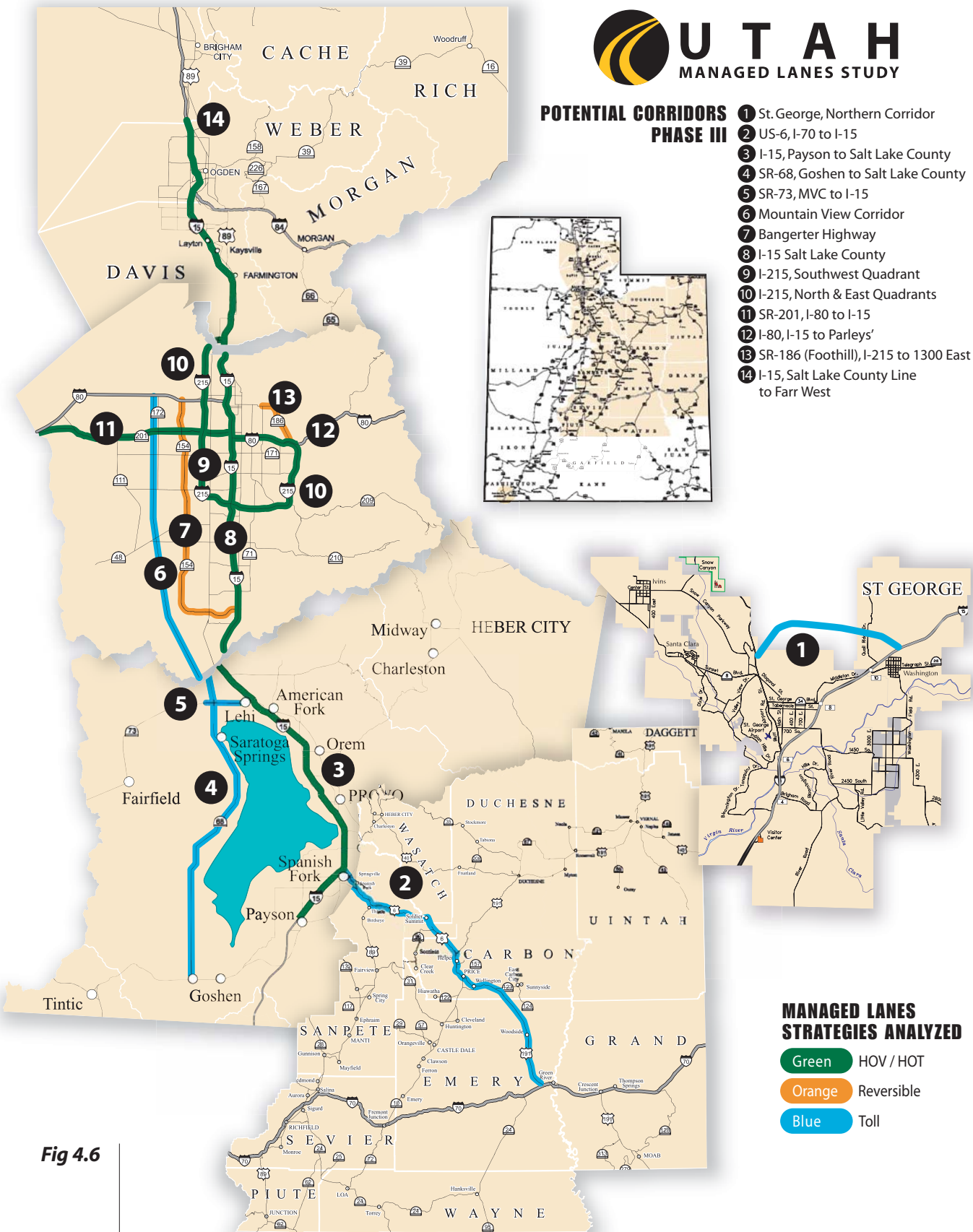


Fig 4.6

REGION ONE Corridor Descriptions

I-15 (Davis County) – Phase II Potential HOV or HOT Facility – I-15 is the only existing freeway facility connecting Davis and Salt Lake Counties. The cross-section along this corridor varies between eight and four lanes. The 2030 LRP proposes to expand I-15 to a maximum ten-lane cross-section. The entire I-15 freeway serves as a major trans-country facility, servicing traffic between Mexico and Canada. As such, I-15 experiences significant daily freight truck traffic.



I-15
Phase III potential
HOV or HOT, Davis
County

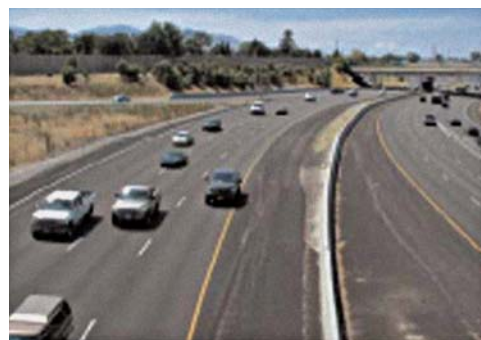
REGION TWO Corridor Descriptions

Bangerter Highway (Salt Lake County) – Phase III Potential Reversible Lane – Bangerter Highway is a six-lane urban expressway, running north/south through the west Salt Lake Valley. The expressway intersects with I-80 to the north and I-15 to the south. Significant directional splits occur on Bangerter Highway during the PM Peak Hour as people commute from businesses in the north to the bedroom communities in the southwest region of the valley. Strong directional splits are projected to continue into 2030, exacerbating congestion on the heavily used expressway. The Wasatch Front Regional Council (WFRC) LRP shows a BRT line on Bangerter Highway by 2030.



Bangerter Highway
Phase III potential
reversible lane Salt
Lake County

I-215 (Salt Lake County) – Phase III Potential HOV or HOT Facility – I-215 is predominately a six-lane freeway that operates as a circumferential belt (3/4) around the core of the Salt Lake urban area, bisecting the major north-south and east-west radial facilities (I-15, I-80, SR-201). Trips on I-215 tend to be of a local nature, as I-15 or I-80 provide a more direct route for regional or through trips. Congestion during the PM peak hour varies on I-215, with the greatest congestion experienced west of I-15, where I-215 operates as a parallel north-south facility to I-15 for some trips. The LRP includes several widening projects on I-215; however, two of these projects do not yet have funding sources.



I-215
Phase III potential
HOV or HOT
facility,
Salt Lake County

FINAL REPORT

Mountain View Corridor

Phase III potential
toll, HOV, or HOT
facility,
Salt Lake County



Mountain View Corridor (Salt Lake County) – Phase III Potential Toll, HOV, or HOT Facility – Mountain View Corridor (MVC) is a proposed future freeway in west Salt Lake Valley. The LRP shows a six-lane alignment at approximately 5800 West. MVC will improve mobility in the western Salt Lake Valley and is forecasted to help alleviate congestion on parallel facilities such as Bangerter Highway and I-15. This new freeway, however, is projected to have demand exceeding capacity during the PM peak period by the year 2030. Funding for construction of this corridor has not yet been identified.

SR-201

Phase III potential
HOV, or HOT
facility,
Salt Lake County



SR-201 (Salt Lake County) – Phase III Potential HOV or HOT Facility – SR-201 is a four-lane freeway connecting Tooele and Salt Lake County to I-15 near the Salt Lake City Central Business District (CBD). The LRP recommends widening SR-201 to a six-lane cross-section, but funding has not yet been identified for the entire project. Even with the proposed widening, SR-201 is forecasted to experience heavy congestion during the PM peak period in 2030.

I-15

Phase III potential
HOT facility,
Salt Lake County



I-15 (Salt Lake County) – Phase III Potential HOT Facility – I-15 in Salt Lake County is a freeway serving regional, commuter, and local trips. The cross-section on this segment of I-15 varies from six to ten lanes. I-15 in Salt Lake and Utah Counties is currently the only transportation facility in the state of Utah with an operating HOV lane. Significant congestion occurs during the existing PM peak period, and this congestion is projected to increase in the future. According to UDOT's Traffic on Utah Highways 2002, I-15 in Salt Lake County carries the highest AADT of any facility in the state.

I-80

Phase III potential
HOV or HOT
facility,
Salt Lake County



I-80 (Salt Lake County) – Phase III Potential HOV or HOT Facility – I-80 is a major freeway, traversing the country between New York City and San Francisco. The freeway carries significant regional truck traffic in addition to local trips. In Salt Lake County, I-80 is a six-lane freeway that connects the SLC CBD to ski resorts, housing, and mountain recreation areas to the east. The LRP shows I-80 expanding to an eight-lane freeway by 2030. I-80 is an important transportation facility for Salt Lake and Summit Counties.

Foothill Boulevard (Salt Lake County) – Phase III Potential Reversible Lane – Foothill is an eastern Salt Lake arterial connecting I-215 and I-80 to the University of Utah and the Salt Lake Central Business District (CBD). The six-lane arterial experiences significant directional splits during the PM peak period as students and employees from the north travel to residential areas in the south. Significant congestion is currently experienced during peak times of the day and this congestion is projected to increase in the future. The WFRC LRP shows express bus service on Foothill Boulevard by 2030.



Foothill Boulevard
Phase III potential reversible lane, Salt Lake County

REGION THREE Corridor Descriptions

I-15 (Utah County) – Phase III Potential HOV or HOT Facility – I-15 in Utah County serves regional, local, and commuter trips to Salt Lake County. An extension of the Salt Lake County HOV lane was recently completed and terminates at the Alpine interchange in Utah County. The cross-section for this section of I-15 varies between eight and four-lanes. The LRP includes widening of the freeway to ten-lanes by 2030. Even with the LRP widening, sections of I-15 in Utah County are projected to experience significant congestion in 2030.



I-15
Phase III potential HOV or HOT facility, Utah County

SR-68 South (Utah County) – Phase III Potential Toll Facility – SR-68 South is the southern extension of Redwood Road (Salt Lake County). The communities west of Utah Lake are currently experiencing significant growth, and this two-lane minor arterial is expected to be an important transportation facility as Utah County continues to develop. The LRP shows that SR 68 South will expand to a four-lane cross-section south of SR 73 by 2030. However, congestion is forecast for this road in 2030 even with this proposed capacity improvement. Although SR 68 is not a new road, a toll analysis was performed to help determine the feasibility of a tollway west of Utah Lake by 2030. Early public feedback from the I-15 expansion project demonstrated public interest in pursuing a toll project west of Utah Lake.



SR 68 South
Phase III potential toll facility, Utah County

SR-73

Phase III potential
toll facility,
Utah County



SR-73 (Utah County) – Phase III Potential Toll Facility – SR-73 is a rural highway that connects the rapidly developing communities in Tooele and western Utah County to SR-68 and I-15. Demand exceeds capacity on the two-lane facility during the PM peak period of the day, and congestion is projected to continue even with LRP capacity improvements. SR-73 will continue to be an important transportation facility as the areas west and north of Utah Lake continue to develop.

The managed lanes potential of the SR-73 corridor hinges on the decisions made on the Mountain View Corridor (MVC). As an extension of MVC, the corridor would have potential as a toll facility. Without MVC, SR-73 would have potential for toll lanes for new capacity.

US-6

Phase III
potential
toll facility,
Emery, Carbon,
and Utah
Counties



REGION FOUR Corridor Descriptions

US-6 (Emery, Carbon, and Utah Counties) – Phase III Potential Toll Facility – US-6 is an important regional facility connecting I-70 in southeastern Utah to I-15 in Utah County. Demand on the two-lane rural highway is projected to exceed capacity during the PM peak period by 2030. This congestion along with a high volume of truck traffic is expected to contribute to future safety issues on this road. This facility primarily serves regional traffic between the Salt Lake urban area and the scenic / recreation / resort areas such as Moab. It also serves inter-regional traffic (especially truck traffic), connecting states to the south and east of Utah with states to the north and west.

Northern Corridor

Phase III potential
toll facility,
Washington
County



Northern Corridor (Washington County) – Phase III Potential Toll Facility – The Northern Corridor is a proposed four-lane principle arterial located to the north of St. George that will operate as the northern segment of a circumferential belt. This facility is projected to help alleviate congestion on St. George Boulevard and improve mobility in the St. George area. By 2030, demand is projected to exceed capacity on this future east/west arterial during the PM peak period.

4.6 Phase III Corridor Performance

This chapter discusses the evaluation of the remaining Phase III corridors. It identifies the assumptions that were made, and how the sketch planning analysis was conducted. The performance measures that were used to evaluate the corridors are identified, and the results of the analysis are presented in tabular format. Finally, recommendations are made with respect to a proposed managed lanes system.

Corridor Operating Assumptions

This study is a preliminary assessment of where managed lanes strategies make the most sense within the state of Utah. As such, a sketch planning level approach was used to evaluate the candidate corridors as opposed to a more in-depth “design level” approach. Although this level of analysis is not adequate to make project, programming, or operational decisions, it will provide UDOT with guidance on corridors where managed lanes are forecast to operate well. Additional analysis would be required to determine detailed corridor performance measures. See “Chapter 6 - Next Steps” for more information regarding the advancement of the recommended corridors towards project development.

For the purpose of this analysis, a number of simplifying assumptions were made to obtain performance results. The following list describes the key data and simplifying assumptions used during performance evaluation:

- The analysis was conducted for the **PM peak period**.
- To facilitate the analysis, **the 14 corridors were subdivided into smaller segments**. For example, I-15 in Region 1 is subdivided into three sections based on logical termini:
 - 1) From the Salt Lake County / Davis County line to Farmington
 - 2) From Farmington to Ogden
 - 3) From Ogden to Farr West
- This study assumes that all tolled corridors will use **Electronic Toll Collection (ETC)**.
- This study used **available traffic data provided by UDOT**. No new traffic data was collected.
- **The Wasatch Front Regional Council (WFRC) Travel Demand Model** was used to estimate future demand and revenue, volume to capacity ratios, and travel times for those corridors within the WFRC region. The WFRC regional model encompasses most of the corridors in UDOT Regions 1, 2, and 3.
- **Four Travel Demand Model runs were completed as part of this project:**
 - 1) 2030 No Build
 - 2) 2030 LRP (includes all of the highway improvements in the WFRC 2030 Long Range Plan)
 - 3) A 2030 HOV network that includes all of the 2030 LRP projects, plus the entire proposed managed lanes HOV network and the proposed toll facilities from the Phase II screening process.
 - 4) A 2030 HOT network that includes the 2030 LRP projects, the entire proposed managed lanes HOT network and the managed lanes toll facilities from the Phase II screening process.

- A systems approach was used to evaluate the candidate corridors, as opposed to an analysis of individual projects as discreet entities. The **reported results reflect the synergistic combined effects of all of the projects when analyzed together as a complete network**. This is particularly noticeable in certain sections of the Salt Lake regional highway network, where there are parallel facilities in close proximity to each other.
- **For the HOT facilities, it is assumed that a variable toll will be implemented** (i.e., the toll will vary according to the level of demand to use the facility). As the congestion increases in the mainline facility, the demand to use the HOT lanes will increase, and therefore, the toll to use the HOT lanes will increase accordingly. The toll will be adjusted to ensure at least a LOS C operating condition is maintained in the HOT lanes during the peak period. Therefore, a higher toll reflects a higher level of demand to use the managed lane facility.
- **For the toll facilities, it is assumed that HOV and SOV vehicles pay the same toll rate.** This is based, in part, on the experience with SR-91 in California.
- **For the toll facilities, a distance based toll of \$0.09 per mile (in 2004 dollars) was used.** This was based on other recently completed studies.
- **The value of time is assumed to be \$9.00 per hour.** This value was used for a previous toll study in the Salt Lake urban area. It is equivalent to 70 percent of the median wage rate in Salt Lake City which agrees with the general rule-of-thumb that the behavioral value of time is typically between 50 percent and 90 percent of the median wage.
- **Operating and maintenance costs** were calculated assuming that a complete managed lanes system would ultimately be developed. This study assumes that it will be possible to achieve economies of scale and that the costs associated with starting a tolling facility (backroom operation costs, revenue collection, customer service, enforcement, etc.) will be **shared by the entire system**.
- It was assumed that any **proposed capacity improvements on HOV and HOT facilities between the present and 2030 would be constructed as HOT/HOV lanes**. For example, if an existing facility that currently has four lanes in each direction will be expanded to five lanes in each direction in the 2030 LRP, the two new lanes would be HOT/HOV lanes. Capacity was never taken from existing general purpose lanes.
- **Capital costs** for implementing managed lanes facilities were developed **from analyzing managed lanes projects and studies in the western United States**. Generic costs were determined for each facility type on a per mile basis and applied to the length of the corridors. Actual development costs could vary significantly according to project location and right-of-way constraints. HOV and HOT capital costs reflect the price of a two-lane facility. Reversible lane capital costs reflect the price of a one-lane facility. It was assumed that Mountain View Corridor would be built as a four-lane facility.

- This study estimated **costs and revenues for the year 2030** (reported in 2004 dollars).
- The LOS for each direction of the two recommended reversible roadways was calculated for every year between 2004 and 2030 using linear extrapolation. **This study recommends a reversible lane treatment until the year the off peak direction begins operating at LOS F.**

Corridor Performance Measures

Three primary performance measures were used to evaluate the 14 corridors as part of the Phase III screening process. These measures are as follows:

- **Travel Demand** – Both the maximum and average volumes were forecast for the PM Peak period in the peak direction, for all 14 candidate corridors. This data was compared to recommended volume per hour per lane (vphpl) thresholds, to identify the corridors where there is sufficient demand to warrant a managed lane facility.
- **Travel Time Savings** – Travel times were estimated for the PM Peak Period in the peak direction, in the year 2030.
 - Congested travel times in the No Build scenario
 - Free flow travel times in the Build scenario
 - PM peak period travel times in the Build scenario on the general purpose lanes adjacent to the managed lane facility
 - PM peak period travel times in the Build scenario on the proposed managed lane facility

As with the volume data, this data was compared to recommended travel time saving thresholds to identify those corridors where there is projected to be a noticeable time advantage for travelers using the proposed managed lane facility.

- **Costs (Capital, Operations & Maintenance) vs. Revenue** – The capital costs to build the proposed facilities, and their annual operating and maintenance costs were compared to the estimated yearly revenue generated by the HOT and toll facilities.

Using a maximum travel demand threshold, the study identified corridors for further consideration



Travel Demand

This study used a maximum (as opposed to a minimum) travel demand threshold to identify corridors that warrant continued consideration. In other words, forecasts for a recommended HOV or HOT facility should be at a level nearing full utilization. Recommended maximum operating thresholds are between 1,200 and 1,800 vehicles per hour per lane (vphpl). However, the actual threshold depends on local congestion levels and how the level of congestion is perceived by highway users. Accounting for traffic conditions in Utah, the volume threshold for this study was assumed to be 1,400 vphpl. Table 4.1 shows the estimated maximum and average 2030 volumes for each Phase III corridor.

One notable exception to this demand threshold is the section of I-15 between I-80 and the Davis County line. This section of I-15 fails to meet the 1,400 vphpl threshold as a HOT facility but is still considered to fulfill the demand performance measure for two reasons:

1. Most of I-15 in Salt Lake County is able to support a HOT toll of \$0.15 per mile. This toll indicates very high projected levels of congestion. In this situation, demand to use the managed lane is extremely high and necessitates charging a high toll so that free flow conditions within the managed lanes facility are preserved. In actuality, HOT tolls can be adjusted to shorter sections along the corridor, and a slightly lower toll on this section of I-15 would increase the volume of traffic above the 1,400 vphpl threshold.
2. From a system continuity standpoint, both sections of I-15 immediately north and south of this 8-mile section meet HOT performance measure thresholds.

The reversible lanes concepts were evaluated differently since their benefit does not extend through the year 2030.

Foothill Boulevard

Without a reversible lane, Foothill Boulevard is forecast to operate very poorly (level of service F) in the peak direction during the PM peak period. By adding a single reversible lane on Foothill Boulevard, congestion is eased through the year 2018.

The reversible lane is expected to improve conditions in the PM peak period direction through 2013 (level of service D) with level of service E conditions through 2030. However, by 2019, traffic volumes in the off peak direction are forecast to increase to the point where the reversible lane results in level of service F conditions in the off peak direction.

Bangerter Highway

Without a reversible lane, Bangerter Highway is forecast to operate very poorly (level of service F) in the peak direction during the PM peak period. By adding a single reversible lane on Bangerter Highway, congestion is eased through the year 2014.

Table 4.1

Corridor	Segment	Length (miles)	Travel Time (minutes)		Strategy	2030 PM Peak Direction with Managed Lanes Facilities			Travel Time with Managed Lanes (min.)		HOV/HOT 5 min. savings?
			Free Flow	2030 No Build		Maximum M.L. Volume ¹	Toll (\$ per mile)	1,400 vphpl threshold ²	Average M.L. Volume ³	Managed Lanes	
Region 1											
I-15	Davis Co. Line to Farmington	10	9.5	80.1	HOV	9,900		yes	9,300	9.6	no
					HOT	8,200	\$0.09	yes	5,900	9.6	yes
	Farmington to Ogden	17	16.1	53.8	HOV	6,300		no	4,900	16.1	no
					HOT	4,600	\$0.09	no	1,900	16.1	yes
	Ogden to Farr West	10	9.0	21.6	HOV	3,700		no	2,400	9.0	no
					HOT	5,500	\$0.09	no	2,300	9.0	no
	Region 2										
Bangerter ³	Salt Lake County	10	15.1	53.8	Reversible	9,400	NA	NA	9,000	23.1	NA
I-215	I-80 West to I-15 North	5	5.0	13.0	HOV	1,500		no	1,500	5.0	no
					HOT	7,600	\$0.03	no	5,300	5.0	no
	I-15 South to I-80 West	10	9.3	17.7	HOV	1,500		no	800	9.3	yes
					HOT	7,600	\$0.03	no	6,000	9.3	no
	I-15 South to 6200 South	5	4.4	4.8	HOV	900		no	700	4.4	no
					HOT	2,500	\$0.03	no	800	4.4	no
	6200 South to I-80 East	5	4.4	5.0	HOV	800		no	600	4.4	no
					HOT	0	\$0.03	no	0	4.4	no
MVC	Salt Lake County	38	35.2	50.4 ⁵	Toll	13,300	\$0.09	yes	9,300	43.6	NA
SR-201	Salt Lake County	10	9.2	39.4	HOV	3,100		no	2,100	9.2	yes
					HOT	7,900	\$0.09	yes	4,800	9.2	yes
I-15	I-80 East to Davis Co. Line	8	7.7	17.6	HOV	8,600		yes	7,300	7.7	no
					HOT	5,100	\$0.15	no	2,400	7.7	yes
	I-80 East to Utah Co. Line	17	15.5	107.0	HOV	12,000		yes	9,200	17.1	no
					HOT	11,000	\$0.15	yes	5,900	16.0	yes
Foothill ⁴	Salt Lake County	3	5.2	13.2	Reversible	7,500	NA	NA	7,100	7.2	NA
I-80	I-15 to Parleys Way	4	3.6	9.1	HOV	2,400		no	2,000	3.6	no
					HOT	8,300	\$0.02	yes	4,400	3.6	no
Region 3											
I-15	University Ave. to Utah Co. Line	16	15.2	53.8	HOV	7,100		no	5,600	15.2	no
					HOT	8,000	\$0.06	yes	6,100	15.2	yes
	Payson to University Ave.	17	15.9	31.1	HOV	3,300		no	1,700	15.9	yes
					HOT	6,700	\$0.06	no	3,700	15.9	yes
SR-68 ⁴	Utah County	32	35.6	44.7	Toll	5,800	\$0.09	no	2,400	37.0	NA
SR-73	Utah County	15	13.6	115.7	HOT	6,900	\$0.02	no	4,600	13.6	yes
Region 4											
Northern Corridor	Washington County	5	6.0	15.0	Toll	7,150	\$0.09	no	5,235	8.0	NA
SR-6	Emery, Carbon, Wasatch	130	140.0	300.0	Toll	5,300	\$0.09	no	2,400	170.0	NA

G.P. Lanes = General Purpose Lanes
M.L. = Managed Lanes

NOTES

- 1- PM Peak (3-hour) Period
- 2- 1,400 vphpl median threshold for HOV/HOT from NCHRP 414. Peak Hour / Peak Period factor = 0.36
- 3- Reversible lane performance is reported for 2005, because the facilities are not recommended through 2030. Managed lanes volume is equal to total peak direction volume.
- 4- It was assumed that SR 68 would function as a freeway type tolled facility.
- 5- Travel time without toll facilities, assuming a four lane facility would be built by 2030.

The reversible lane is expected to improve conditions in the PM peak period direction through 2017 (level of service D) with level of service E conditions through 2030. However, by 2015, traffic volumes in the off peak direction are forecast to increase to the point where the reversible lane results in level of service F conditions in the off peak direction.

The analysis shows that the demand to use the managed lanes exists on several facilities. In particular, both the maximum and average PM Peak period volumes approach or exceed the designated threshold for I-15 from Farmington to the Salt Lake County / Utah County line and Mountain View Corridor.

Travel Time Savings

The attractiveness of HOV and HOT facilities depends to a large extent on their average speed in relation to the average speed of the traffic in the adjacent general purpose lanes. National Cooperative Highway Research Program (NCHRP) Report 414 recommends an overall minimum travel time saving of five minutes over the entire length of the proposed facility. Time differentials were calculated by comparing the PM peak period and peak direction travel time of the HOV / HOT corridor to the general purpose lanes. Table 4.1 shows the estimated travel times for each Phase III corridor.

With toll roads, all lanes are managed. As such, travel times savings were measured based on the travel times along adjacent facilities rather than adjacent lanes on the toll road.

Reversible lane travel time savings are reported for the year 2005 since the facilities are not recommended through 2030.

The analysis shows that a time differential of greater than 5 minutes exists between managed lanes facility travel times and travel times for adjacent general purpose lanes.

Electronic toll collection
eliminates many
of the operational
costs associated
with toll and HOT
facilities



Costs and Revenue

In addition to travel demand and travel time savings, candidate corridors were also evaluated with respect to their costs and revenue potential. Based on our planning level analysis, a direct financial benefit may be observed for candidate toll corridors and HOT lanes.

Although many operational costs associated with toll and HOT facilities are eliminated with Electronic Toll Collection, costs related to the following operational elements can not be avoided:

- Customer service center
- Violation enforcement
- Traffic enforcement
- Maintenance
- Administration

As mentioned previously, by implementing the proposed managed lanes strategies as a system, many of the costs can be shared by all of the facilities.

For the purposes of estimating annual revenues, PM Peak period volumes were converted to PM Peak Hour volumes. These volumes were then multiplied by the specified toll rates, the length of the designated managed lanes facility, and the annual hours of operation to determine annual revenue.

Costs and revenues were found to be consistent with other toll and HOT facilities throughout the United States.

The following four candidate corridors were shown to have a high potential of generating annual revenues in excess of their annual operations and maintenance costs:

- I-15 HOT lanes (Davis County Line to Farmington)
- I-15 HOT lanes (I-80 east to Utah County Line)
- Mountain View Corridor tolled facility
- SR-68 tolled facility (Utah County)

Proposed System

The results of the Phase III corridor performance indicate that several Utah corridors have high potential as managed lanes. Corridors with high potential meet at least two Phase III performance measure thresholds. In some cases these corridors are shown to perform well above the specified thresholds. These corridors include:

- I-15 between Farmington and Provo (University Avenue)
- Mountain View Corridor
- SR-201 in Salt Lake County (I-80 to I-15)

Several corridors show medium potential as managed lanes facilities. Corridors with medium potential met at least one of the Phase III performance measure thresholds. These facilities include:

- I-15 from Farmington to Ogden
- I-80 from I-15 to Parleys Way
- SR-68 from Nephi to Salt Lake County
- I-15 from Provo to Payson
- SR-73 between Mountain View Corridor and I-15
- I-215 between I-80 west and I-15 south (SW quadrant)
- Bangerter Highway would benefit from the near term implementation of reversible lanes
- Foothill Boulevard would benefit from the near term implementation of reversible lanes
- Northern Corridor in Washington County

Remaining corridors are considered to have low potential as managed lanes facilities, and include:

- I-15 between Ogden and Farr West
- I-215 from I-80 west and I-15 north (NW quadrant)
- I-215 from I-15 south to I-80 east (SE quadrant)
- US-6 in Emery, Carbon, Wasatch, and Utah Counties

Figure 4.7 displays the proposed managed lane system according to these three levels of potential.

As managed lanes are developed, the study recommends the following:

- Implementation of HOT lanes over HOV lanes for managing the existing Utah freeway system, given the high lane usage forecasts and potential for financial benefit
- Consideration of managed lanes in all future projects within the Phase III corridors
- Reevaluation of managed lanes strategies as additional capacity improvements within these Phase III corridors are considered

¹ "New Jersey Decommissions its HOV Lanes - Will This Establish a Precedent?," Innovation Briefs, Nov/Dec 1998.

² Traffic Risk in Start-Up Toll Facilities. Standard & Poor's. September 2002.

³ Traffic Forecasting Risk: Study Update 2004. Standard & Poor's. October 19, 2004.

⁴ Bain, Robert and Michael Wilkins. Road Risk: How reliable are existing traffic risk models for new toll road financings? Project Finance magazine. September 15, 2002.

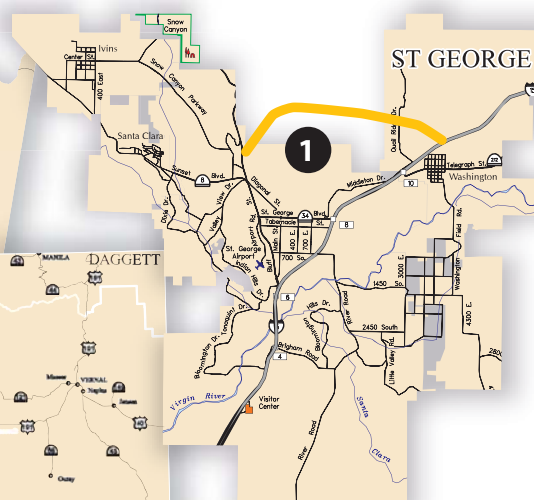
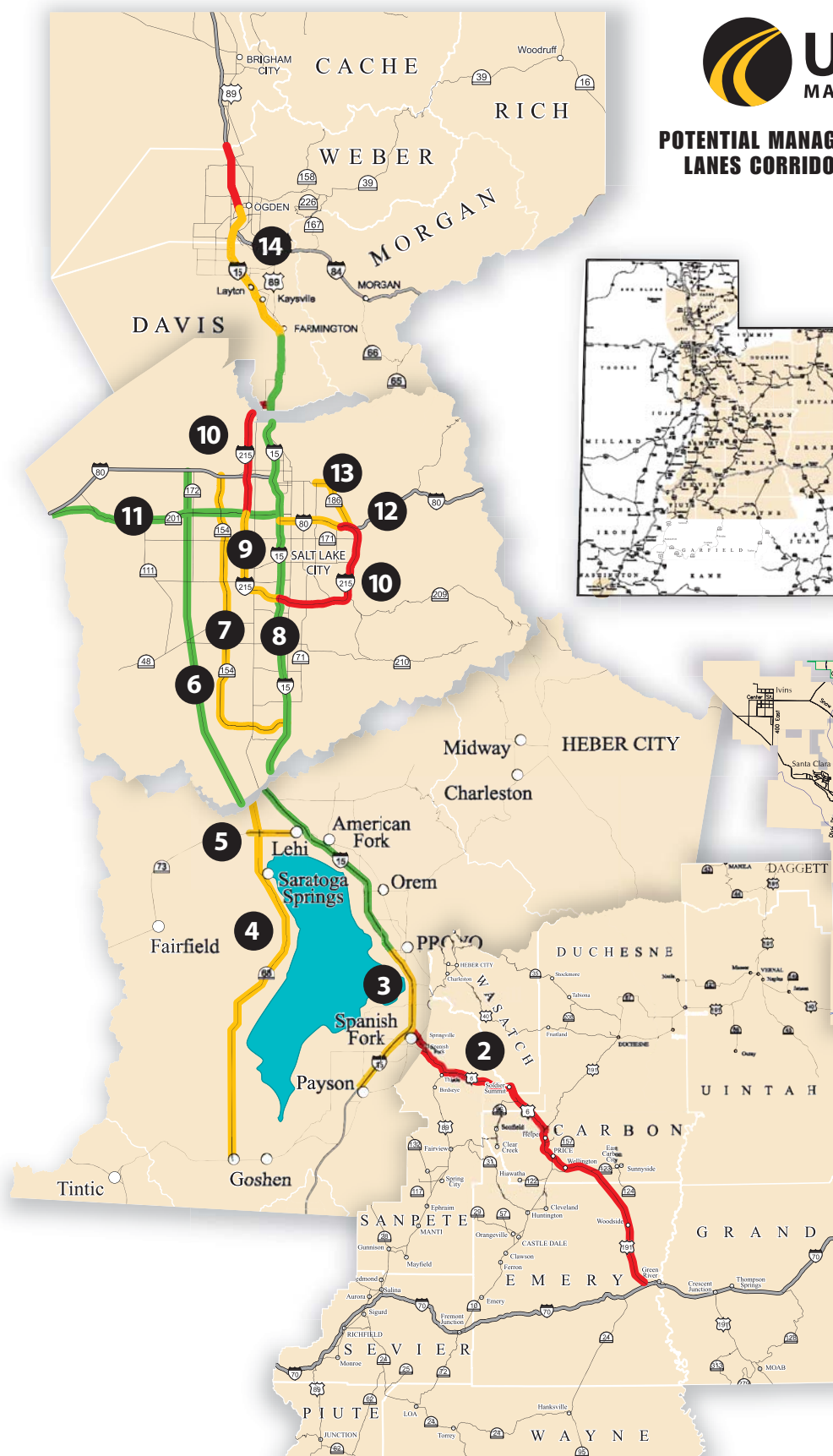
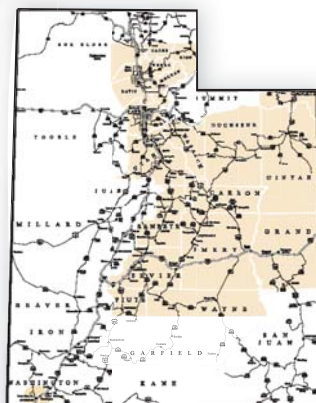
⁵ Muller, Robert H. Examining Toll Road Feasibility Studies. Municipal Finance Journal. Spring 1997.

⁶ HOV Systems Manual. NCHRP 414.

UTAH MANAGED LANES STUDY

POTENTIAL MANAGED LANES CORRIDORS

- 1 St. George, Northern Corridor
- 2 US-6, I-70 to I-15
- 3 I-15, Provo to Payson
- 4 SR-68, Goshen to Salt Lake County
- 5 SR-73, MVC to I-15
- 6 Mountain View Corridor
- 7 Bangerter Highway
- 8 I-15, Farmington to University Ave
- 9 I-215, Southwest Quadrant
- 10 I-215, Southeast & Northwest Quadrants
- 11 SR-201, I-80 to I-15
- 12 I-80, I-15 to Parleys' Way
- 13 SR-186 (Foothill), I-215 to 1300 East
- 14 I-15, Farmington to Ogden & Ogden to Farr West



- High Managed Lanes Potential
- Medium Managed Lanes Potential
- Low Managed Lanes Potential

Fig 4.7



Chapter 5 - Opportunities and Constraints

Managed Lanes as a concept is still new in Utah. The report thus far has focused primarily on case studies and technical analysis. The intent of this section of the report is to identify those issues that are critical to the implementation of the recommended corridors. This range of topics includes statutory and other institutional concerns, as well as financial and public issues. These issues are addressed through a series of “frequently asked questions,” or FAQs. These questions are designed to answer questions a policy-maker or the public might have about managed lanes and how they could function in Utah.



5.1 General Information

1. Do any toll roads currently exist in Utah?

Yes. The Adams Avenue Parkway, in Weber County, is Utah's first modern-day toll road. The parkway opened in June of 2001, and extends from I-84 to 5900 South for a total length of one mile. It was built by private developers who wished to provide access to over 100 acres of their own land for real estate development. According to the developers, the Adams Avenue Parkway carries about 1,300 vehicles per day, most of which are commuters into central Ogden and Washington Terrace from outside the area. The developer's engineers estimate that daily traffic on the toll road could reach 8,800 by 2020. The toll is \$1 and can be paid in cash or with an electronic self-swipe card. In addition, recreational routes such as Antelope Island Causeway, Mirror Lake Highway (SR-150), and Millcreek Canyon have fee stations which effectively function as toll roads.

2. Has Utah had any toll roads in the past?

Yes. Parley Pratt constructed a toll road between Park City and the Salt Lake Valley, through what is known today as Parley's Canyon. The toll road opened in 1850, and was marketed toward travelers immigrating to California from the east. Fees on Pratt's “Golden Pass Road” were roughly \$1 per loaded wagon. The toll road was in operation for one year, and fell into disuse in 1851.

3. What would a modern managed lanes project in Utah look like?

For an example of a non-barrier separated HOV facility refer to I-15 in Salt Lake County (See picture in Chapter 3 HOV case study #3). Examples of HOV/HOT barrier separated facilities are provided on the next page. Additional examples are provided in the Appendix.

Fig 5.1

Median-Based Two-Lane Reversible Flow HOT/HOV Cross-Sections
(Guide for HOT Lane Development, FHWA)

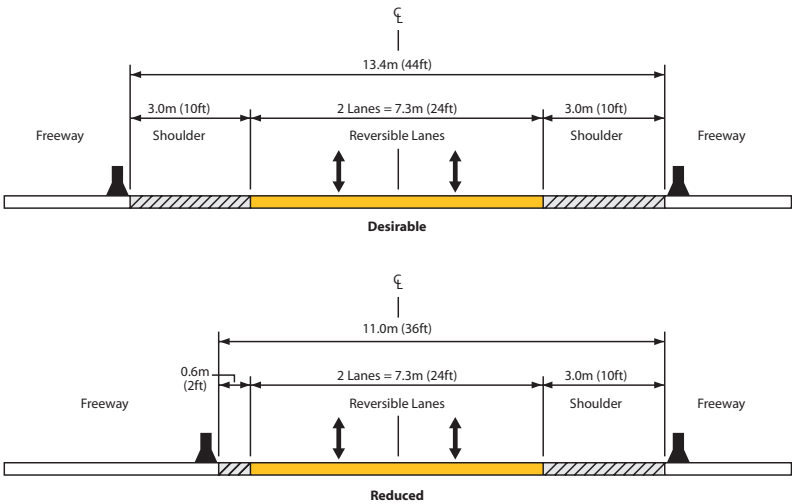
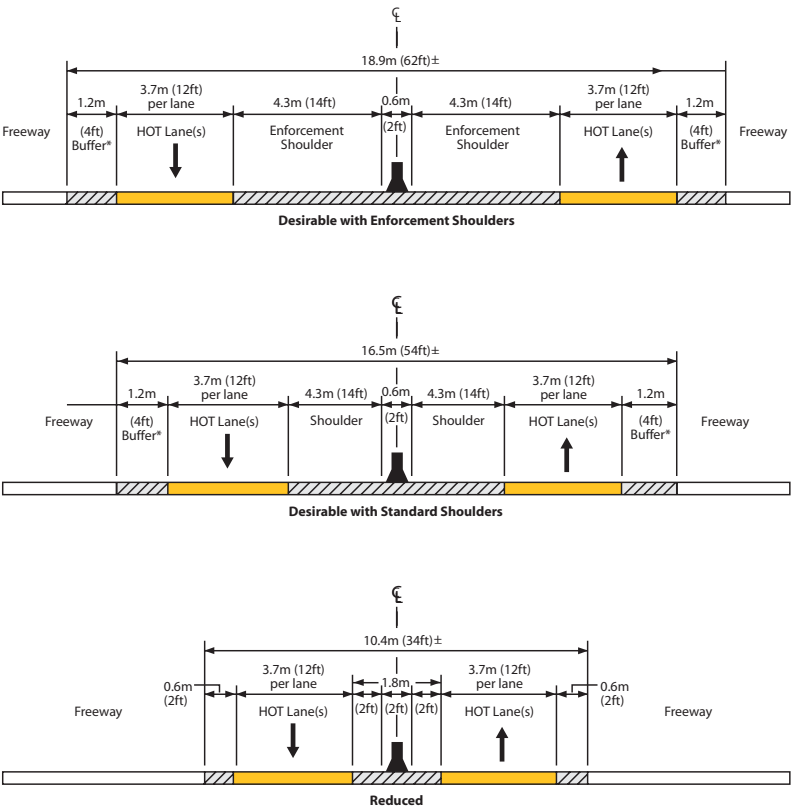


Fig 5.2

Median-Based Concurrent Flow HOT/HOV Cross-Sections
(Guide for HOT Lane Development, FHWA)



* Buffer area may include permanently placed pylons or traffic channelizers

5.2 Public Perception

4. How does the public feel about tolling?

Public opinion on priced roads tends to vary. According to a June 2004 poll of residents of South County, California, 77 percent felt the local toll road systems have been helpful in reducing freeway congestion. In contrast, a recent survey of residents of several major urban areas in Texas found less support for toll roads. Fifty-one percent of the Texans surveyed felt drivers should not have to pay tolls on new roads, and 71 percent believe drivers shouldn't pay tolls on existing roads either.

Dan Jones & Associates recently conducted a local public opinion poll about UDOT in general which included several questions relating to managed lanes. The poll showed that 29 percent of Utah residents thought UDOT probably should or definitely should consider toll roads as a potential solution for decreasing commute time. However, 64 percent of those polled did not think UDOT should consider tolls as a potential solution for decreasing commute time (seven percent were undecided). These low approval numbers are expected and consistent with the experience of other states when tolls are initially discussed. However, public opinion frequently becomes more favorable as the public learns of the benefits of tolling specific facilities.

5. What amount of travel time savings does the public expect from a tolled facility?

According to the Dan Jones poll, nearly half of the respondents (46 percent) expected to reduce commute times by 10 to 20 minutes if they were paying a toll. Fifteen percent expected a reduction of 21 to 30 minutes in exchange for a toll. A small portion, two percent, stated that they would not pay for a toll road regardless of how much it reduces commute travel time.



6. Is the public willing to allow Single Occupant Vehicles (SOV) to use the HOV lanes for a fee?

The Dan Jones poll found that the public is not willing to allow single occupant vehicles use HOV lanes, even for a fee. In fact, 54 percent responded they would strongly oppose this, with an additional 19 percent somewhat opposed. 60 percent responded they definitely would not pay a fee to legally use the carpool lane as a single occupant vehicle. These low approval numbers are expected and consistent with the experience of other states when tolls are initially discussed. However, public opinion frequently becomes more favorable as the public learns of the benefits of tolling specific facilities. A recent San Diego public opinion poll showed that the majority of residents across all socio-economic levels approve of HOT lanes.

5.3 Financial Issues

7. How would the revenue collected from a managed lanes facility be used (or allocated)?

Utah Code §72-6-118(7) directs that all revenue generated from a tollway on a state highway must be deposited in a Tollway Restricted Account and used for acquisition of right-of-way and the design, construction, reconstruction, operation, maintenance, and enforcement of transportation facilities within the corridor served by the tollway.



8. How would the money from fines for toll violations on a managed lanes facility be used (or allocated)?

Utah Code §41-6a-716 provides that a person who fails to pay a toll is charged with a class C misdemeanor. Depending on the jurisdiction in which the violation occurs, revenue generated from a misdemeanor fine goes to the local government entities in which the violation occurred, or are split between a local government entity and the state (§78-5-116 and §78-3-14.5). Revenues to the state are deposited in the general fund. None of the revenue generated from toll violations would go to the transportation fund or to the tollway in which the revenue is generated. Consideration should be given to modify Utah code to allow those revenues to go to the transportation fund or Tollway Restricted Account.



9. Can UDOT enter into a public-private partnership to build a tolled facility?

Broadly interpreted, Utah Code §72-6-1182(b) could allow UDOT to enter into a public-private partnership to build and operate a tollway or related facility. However, modification of the code may be needed to clarify that authority and to provide the statutory framework necessary to attract potential private investment.

5.4 Local Institutional Issues

10. Does UDOT have the authority to build a toll road?

Yes. Under Utah Code §72-6-118(3), UDOT may establish or operate a tollway on a state highway. Establishment of HOT lanes or a tollway on a new facility must be approved by the Utah Transportation Commission. Toll facilities on an existing state highway must be approved by both the Utah Transportation Commission and the Utah State Legislature.

11. Does UDOT have the authority to build a HOT lane?

Yes. Under Utah Code §72-6-118(3)(d), UDOT may establish HOT lanes with approval of the Utah Transportation Commission.

12. Do any local governments have the authority to build a toll road?

No. Section 72-6-118 establishes UDOT's authority to build and operate toll roads, but it does not specifically delegate this authority to local governments as well. However, in the recent past, private developers have been able to build their own toll road: for example, the Adams Avenue Parkway in Weber County. UDOT's cooperation was not required for the parkway's construction, except for those areas where the parkway intersected with existing state roads. Future legislation on this topic may need to clarify which local government agencies have the authority to build toll roads.

13. Which agencies would enforce a managed lanes facility?

Utah Code §72-6-118(2)(a) allows UDOT to enforce toll and related facilities while Section (b) enables UDOT to enter into contracts for the toll facility. For example, UDOT could contract with off-duty UHP to enforce the tollway. Further consideration should also be given to the idea of more effectively enforcing tollways through administrative actions. For instance, in Texas the Toll Authority can hold a vehicle registration renewal until toll violations are paid.

14. Does UDOT have the authority to make an existing "free" road a toll road?

Under §72-6-118 UDOT has authority to establish a tollway on an existing state highway, but only with approval by both the Utah Transportation Commission and the Utah State Legislature. However, HOT lanes may be established on an existing facility with approval by the Utah Transportation Commission.

15. Where do managed lanes fit into the current project development process?

See Chapter 6 for a full discussion of this topic.

16. How is the State Transportation Commission involved with managed lanes decisions?

Under §72-6-118 the Utah Transportation Commission may approve tollways for new state facilities or HOT lanes on an existing facility. Tollways on existing state highways must be approved by both the Transportation Commission and the Utah State Legislature. The Commission may determine priorities and funding levels for tollways; may provide funds to public or private tollways from General Funds appropriated for that purpose by the legislature; sets the amount of the toll imposed; and must review rules proposed by UDOT through the rulemaking process to establish and operate tollways.

17. How is the State Legislature involved with managed lanes decisions?

The legislature must approve all tollways established on existing state highway facilities. Also, legislators would be involved through public involvement of the normal environmental process.

5.5 National Institutional Issues

18. What is the Federal Highway Administration (FHWA) position on managed lanes?

FHWA supports the creation of managed lanes. In November 2003, FHWA and the Transportation Research Board (TRB) held a two-day workshop to identify ways to implement managed lanes and to encourage managed lanes research and initiatives. At the same time, FHWA was working with the Texas Transportation Institute (TTI) to develop a managed lanes initiative; the goal of the initiative was to guide future research and development of managed lanes.

Furthermore, the Federal Highway Administration's Value Pricing Pilot Program (under TEA-21) offers state departments of transportation an opportunity to secure federal matching funds for implementing a range of value pricing (congestion pricing) types of projects. Types of projects include area-wide pricing, pricing of multiple or single facilities or corridors, single lane pricing, and implementation of other market-based strategies, such as area-wide Parking Cash-Out demonstrations.

19. What is the Federal Transit Administration (FTA) position on managed lanes?

FTA follows FHWA in its support of managed lanes.

20. What new managed lanes choices are available under the Administrator's proposed SAFETEA?

SAFETEA proposes several changes to prior legislation regarding managed lanes. Section 1610, "Use of High-Occupancy Vehicle (HOV) Lanes," proposes the following changes:

- a. Responsible agencies could charge a toll for single-occupant vehicles to use HOV lanes, effectively establishing an HOT lane. This addition to the legislation also requires the agencies to create a program detailing how these vehicles can utilize a HOT lane.
- b. Responsible agencies can allow single-occupant vehicles to use the HOV lane without paying a toll, if they meet low-emission and fuel-efficiency standards. The vehicles must meet the EPA's Tier II standards for light-duty vehicles, and have a fuel efficiency of 45 miles per gallon or higher.

Section 1615 of SAFETEA establishes variable toll pricing authority for any road network. A state or public authority may levy a toll on any highway, bridge or tunnel, to manage high congestion levels or reduce emissions in a nonattainment area. These tolls are intended to be temporary, but they can be continued under certain circumstances—for instance, if the facility being tolled has outstanding debt related to the implementation of the variable toll pricing.

Final modifications to federal law affecting managed lanes will be determined by Congress.

Chapter 6 - Next Steps

6.1 Introduction

This chapter presents potential “next steps” in the managed lanes process and outlines approaches for bridging the gap between concept development and implementation.

Key “next steps” include:

- Clearing existing institutional hurdles
- Incorporating managed lanes corridors into the short and long-range planning processes
- Incorporating managed lanes into the UDOT project development process

With proper planning and implementation, the first managed lanes project in Utah is likely to be a tremendous success. However, the success of any managed lanes project will depend on the guarantee of safety, the degree of public acceptance, the ability of the project to meet its publicly stated objectives, and the ultimate efficiency of traffic operations.

The following sections discuss each of the key “next steps” in order of chronological importance. (i.e., Institutional issues should be addressed before adopting a managed lanes strategy into the long-range plan, a detail corridor study should be performed before carrying the corridor through the project development process, etc.)

6.2 Institutional Hurdles

The institutional issues facing Utah involve legislation, public acceptance, and government organization.

Legislative Issues

The State Legislature has accepted the concept of managed lanes more readily than initially expected. The recent legislative discussion and subsequent bill allowing HOT lanes has been positive and progressive. UDOT should continue to work with elected officials to ensure that the key managed lanes legislative measures receive attention in the coming years. For example, Utah has existing legislation regarding the use of toll roads; however, the language surrounding this authority is somewhat ambiguous. Clarifying UDOT’s authority regarding the implementation of tolls and other managed lanes strategies will be an important legislative issue prior to implementation of projects.



The 2005 legislative session gave the Transportation Commission the authority to designate a corridor as a toll or HOT facility

Public Acceptance

The experience of other states shows that managed lanes receive the most attention during the project implementation phase. Public outreach and education will peak during these critical project times, but early primers can help ease public reaction. UDOT’s recent involvement with HOV promotion is one example of a high visibility managed lanes public outreach process. Similar campaigns with reversible lanes, HOT lanes, and toll roads will be beneficial. In addition, UDOT Community Affairs should continue to be well briefed and remain consistent in their communications regarding managed lanes.



UDOT’s HOV campaign, “Carpool, it’s the travel decongestant” reached the public through media relations, billboards and radio ads

Organizational Structure

The last major institutional hurdle for successful managed lanes projects is the development and implementation of an effective organizational structure within UDOT. An effective managed lanes implementation effort will have a clearly defined project purpose and a high degree of interagency coordination.

The first important attribute of the organizational structure is a clearly defined and consistent project purpose. Managed lanes can be used as congestion management strategies, financial management tools, or both. Managed lanes will give Utah more flexibility in balancing fiscal and functional needs. This study shows that agencies often have differing objectives when implementing managed lanes. San Diego, for example, is clearly using HOT lanes as a congestion management tool, while other states such as Texas, are tolling to support the construction and operation of their freeways. UDOT should decide whether to pursue projects from a financial benefit standpoint, a congestion management standpoint, or on a case-by-case basis. The emphasis chosen by UDOT will largely determine the types of projects selected. With a clearly defined purpose, managed lanes projects will more successfully address Utah's fiscal and functional needs.



In other cities transit is highly integrated into managed lanes facilities and requires interagency coordination

The next important attribute from an organizational perspective is a high level of interagency coordination. There are so many details associated with managed lanes that fully controlling a project can be overwhelming for even an organization as large as UDOT. For example, enforcement should be a multi-agency undertaking due to some complexities of projects such as HOT lanes. Other successful

projects involved strong relationships with the transit providers in their regions. San Diego and Houston are two obvious examples where transit, especially Bus Rapid Transit (BRT), is highly integrated into the managed lanes facilities. As a result, the Federal Transit Administration (FTA) is involved in those areas, providing additional funding and resources.

As appropriate, UDOT should include MPOs, UTA, the UHP, and effected local governments in the planning and implementation processes of managed lanes as discussed above. These groups can provide technical resources as well as a better representation of the local and special interests through the planning process

6.3 The Next Level of Planning

UDOT has taken an important first step by taking a systems approach with this managed lanes study. As it relates to next steps, there are quite a few options available to UDOT.

Although this study began with a statewide view, the corridors recommended are generally located within the Wasatch Front urban area. As a result, a next step may include a Wasatch Front Managed Lanes Systems Plan.



This system plan could include a more in-depth technical analysis of the opportunities and constraints for managed lanes implementation along the Wasatch Front including:

- Collection and analysis of current data
- More extensive utilization of the regional travel demand model
- State-of-the-practice micro-simulation to analyze traffic operations
- Identification of a logical, phased system of managed lanes improvements
- Clarification of additional issues such as the role of transit

The system plan could also include an implementation schedule along with more detailed costs. A goal would be to integrate the plan into the Mountainland Association of Governments (MAG) and the Wasatch Front Regional Council's (WFRC) Regional Transportation Plans.

Assuming that a few managed lanes projects are implemented, MPOs would be able to account for expected or actual revenues in their regional funding "budgets." This may in turn increase the region's long range transportation "budget."

As an element to the system plan, an open public process would provide a forum for transportation stakeholders to expand their view and understanding of managed lanes concepts.

Regardless of the planning approach, the key is for UDOT to move forward with next steps and take advantage of the current managed lanes momentum.

6.4 Project Development

As institutional issues are resolved and additional planning studies completed, the next area for further consideration is the project development process. Managed lanes projects can be developed in a number of ways: publicly, privately, or through a public/private partnership. The method of development will depend largely on the type of project and location.

This section focuses primarily on the public project development process, although the possibility for private or public/private ventures should not be dismissed. There are advantages and disadvantages to private and public/private endeavors. Advantages to involving a private enterprise may include reducing the project completion time, increasing the experience level related to implementing and operating managed lanes facilities, and a more diverse pool of funding resources. Disadvantages may include increased contract complications/restrictions and the potential for conflict between public and private interests.

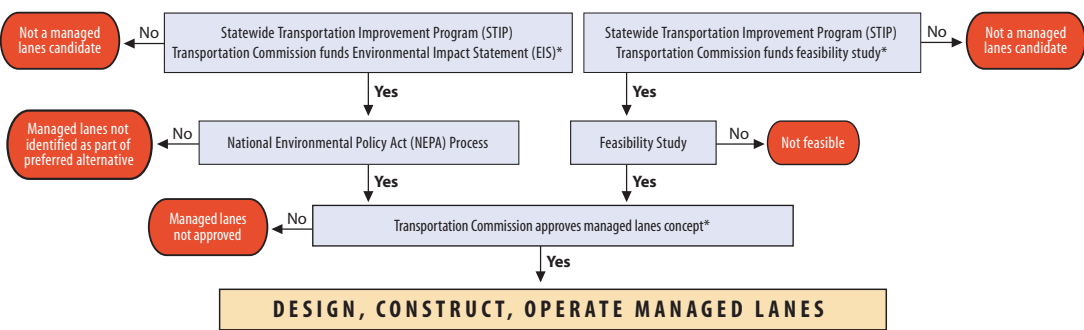
Figure 6.1 shows the managed lanes decision making process. As shown, there is a large role for UDOT project development support on managed lanes. This study, by design, only took the first step.

As the role of and opportunity for managed lanes increases, UDOT should continue to explore issues related to design standards, technology opportunities, and enforcement methods. By continuing to work with their peers, UDOT can focus on lessons learned while getting a better feel for how managed lanes will ultimately fit into the project development process.

The majority
of recommended
corridors are
located within
the Wasatch
Front urban area

Fig 6.1

MANAGED LANES DECISION-MAKING PROCESS



*Indicates decision-making point and public input.

Another important issue to continue exploring is how managed lanes fits within the current National Environmental Policy Act (NEPA) and state environmental processes. The Federal Highway Administration (FHWA) has yet to take the national lead in providing guidance on specific managed lanes requirements. There are important questions regarding managed lanes within the context of NEPA. For example, when should managed lanes be included within the pool of alternatives? How will managed lanes compare against traditional solutions, or even against transit solutions? Can a purpose and need statement consider the lack of funding as a core element? Can purpose and need be directed to a managed lanes outcome? What if the non-managed lanes function poorly; is that acceptable, a good investment of public funds, and a possible breach of public trust? What about social equity and value pricing in general; have there been challenges to pricing based on Environmental Justice?

Despite the questions that remain, this study provides a primer of the state of the practice of managed lanes in the U.S. It identifies managed lanes strategies as an important tool to successfully addressing Utah’s current and future travel demand. Through the three phase sketch planning process, 14 corridors were identified as being feasible candidates for managed lanes strategies. As UDOT continues moving forward, key managed lanes issues related to institutional hurdles, future planning processes, and ultimately the development of managed lanes projects will need to be addressed. Since the managed lanes concept is, for the most part, new to the traveling public there is much to be learned as UDOT moves forward with these important next steps.

Appendix

Planning Sources

Portland, OR

http://www.metro-region.org/library_docs/trans/2002_chapter_1.pdf

A regional transportation policy plan framing the direction for future planning in the Portland region. The Regional Transportation Plan was guided to development by a citizen advisory committee. The Regional Vision was to link urban form with transportation. Regional Transportation policies are grouped into seven subject areas: public process, connecting land use, equal access and safety, protecting the environment, designing the transportation system, managing the transportation system and implementing the transportation system. Policies aim to implement the 2040 Growth Concept and limit dependence on any single mode of travel and increase the use of transit, bicycling, walking, carpooling, and vanpooling. The plan aims to integrate land use, automobile and transit needs in regional and local streets.

Minneapolis, MN

<http://www.oim.dot.state.mn.us/StatePlan/index.html>

The Minnesota Statewide Transportation Plan discusses the direction that transportation is taking from 2003 to 2023. The statewide plan is long-range for transportation investment and decision-making. It identifies performance measures that will be used to determine how well Mn/DOT is meeting citizen expectations in providing infrastructure and services. Mn/DOT's planning process began with its strategic plan which was established in 1997 and revised most recently in 2003. Its goals are to safeguard what exists, make the transportation network operate better and make Mn/DOT work better. It lists ten policies and lists performance measures. Policies are shown below:

- Preserve Essential Elements of Existing Transportation Systems
- Support Land Use Decisions that Preserve Mobility and Enhance the Safety of Transportation Systems
- Effectively Manage the Operation of Existing Transportation Systems to Provide Maximum Service to Customers
- Provide Cost Effective Transportation Options for People and Freight
- Enhance Mobility in Interregional Transportation Corridors Linking Regional Trade Centers
- Enhance Mobility within Major Regional Trade Centers
- Increase the Safety and Security of Transportation Systems and Users
- Continually Improve Mn/DOT's Internal Management and Program Delivery
- Inform, Involve and Educate All Potentially Affected Stakeholders in Transportation Plans and Investment Decision Processes
- Protect the Environment and Respect Community Values

The cost effectiveness framework Mn/DOT adheres to is benefit/cost analysis, best value assessment and application of social, environmental, community, and business impacts and goals. The plan outlines major trends and transportation implications such as travel increasing by 84% in respect to vehicle-miles traveled and commute time increasing. Transportation funding is 12% of annual state government spending. Ninety percent of Mn/DOT's funding for transportation goes to construction and maintenance.

Minneapolis, MN

<http://www.metrocouncil.org/planning/transportation/TPP/tppindex.htm>

The Minnesota Legislature established the Metropolitan Council in 1967 to coordinate planning and development within the Twin Cities metropolitan area and to address issues that could not be adequately addressed with existing governmental arrangements. The Metropolitan Council is the regional planning agency serving the Twin Cities seven-county metropolitan area and providing essential services to the region. The Council works with local communities to provide these critical services:

- Operates the region's largest bus system
- Collects and treats wastewater
- Engages communities and the public in planning for future growth
- Provides forecasts of the region's population and household growth
- Provides affordable housing opportunities for low- and moderate-income individuals and families
- Provides planning, acquisitions and funding for a regional system of parks and trails
- Provides a framework for decisions and implementation for regional services including aviation, transportation, parks and open space, water quality, and water management

This website contains links to the Transportation Policy Plan adopted January 24, 2001. Each link is associated with a chapter in PDF format for the TPP. The following is a list of chapters included: Transportation and Smart Growth; Existing Transportation System and Issues; Policies and Strategies; 2025 Regional Transportation Plan; Regional Transportation Plan; Federal Requirements; Work Program. Chapter 4 is outlined below.

Minneapolis, MN

<http://www.metrocouncil.org/planning/transportation/TPP/TPPChapter4.pdf>

The 2025 regional Transportation Plan is an optimistic intermodal approach to addressing the needs of the Twin-Cities region. The transit system plan includes a network of dedicated transit corridors to be developed. These transitways include high-occupancy vehicle (HOV) lanes, exclusive busways, LRT and commuter rail, providing a transit-time advantage over single occupant autos, improve transit service reliability, and boost potential for TOD. By 2010 these transitways would include 2 LRT lines, at least one commuter rail line, and two exclusive busways to Minneapolis and St Paul. Supporting these corridors would be extensive park-and-ride facilities, ramp meter bypasses, and transfer points.

Congestion is currently estimated to cost \$1 billion now and will double by 2020. The transit plan outlines transit solutions for various areas of the twin-cities as described below:

- Core Transit Area - strong transit presence
- Inner Urban/Suburban Transit Area - frequent available service 12 to 18 hours a day, seven days a week.
- Outer Suburban Transit Area - peak-period express bus service
- Rural Transit Area - dial-a-ride, ridesharing

The region's bus system will continue to be the foundation of transit services. The bus fleet will be expanded and diversified to meet customer needs and improve cost efficiency. The region will develop a system of hub-and-spoke transit hubs. Exclusive busways constructed by 2010 could be converted to LRT, if appropriate, at a later date. Freeway transit corridors would rely on bus-only shoulders and HOV lanes. The goal is to free all express routes from congestion with transit advantages.



The cost of the transit plan is detailed and an ABC investment strategy created in 1999 was applied to the transit plan: "A" advantages for transit; "B" bottleneck removal; "C" interregional corridors - provide safe and efficient transportation between regional trade centers in Minnesota and adjacent states.

Highway System Management - over the next 25 years, \$510 million has been allocated to this category of projects. Although 400 ramps are now metered, only 72 HOV bypasses have been built. Today 20 miles of HOV lanes and 100 miles of bus shoulder lanes exist. Enforcement of HOV ramp meter bypasses and lanes is critical for their successful operation.

North Central Texas Council of Governments

http://www.dfwinfo.com/trans/mtp/current/mob2025update_SummaryPresentation.pdf

Mobility 2025 is a PowerPoint summary describing the purpose, organization, and funding for a Metropolitan Transportation Plan. The region is larger than Maryland in population, employment, and land area. North Central Texas is the ninth largest urban region in the country. Growth in this region will increase from 5 million persons in 2000 to nearly 9 million persons in 2030. Regional transportation constraints include:

- Funding - \$3.3 billion revenue shortfall through 2025
- Congestion - \$8.2 billion congestion cost in 2025

Growth to this region means 2000 freeway lane miles, 700 miles of HOV, and 300 miles of rail. Mobility 2025 update was adopted in May 2001. It identifies \$49 billion of policies, programs, and projects. It is a multimodal system including light rail/commuter rail, HOV lanes, freeways/tollways. Management and operations include transportation systems management, intelligent transportation systems, travel demand management, and bike/pedestrian facilities. All HOV facilities will be managed for mobility efficiency. Right-of-way preservation should be encouraged in all freeway corridors to accommodate potential future HOV facilities. Four percent (\$2,115) of total money available for metropolitan transportation system components is allocated to HOV and managed facilities; 24% (\$11,528) to freeway and toll road system; 18% (\$8,653) to rail and bus transit system.

Seattle, WA, Destination 2030 Plan

<http://www.prsc.org/projects/mtp/chapter6.pdf>

Destination 2030 outlines a set of financial principles, conditions, and assumptions that constitute a final strategy for implementation. Principal transportation tax bases include retail sales, registered motor vehicles, taxable motor fuel consumption, and taxable value of motor vehicles. In 1998, the state legislature and Governor created a Blue Ribbon Commission on Transportation (BRCT) to conduct a comprehensive analysis of statewide transportation needs and priorities. The commission was comprised of public and private sector representatives, was charged with developing recommendations for identifying funding, and delivering key transportation services and projects. The Blue Ribbon Final Report recommends that existing statewide revenue sources be enhanced and new sources found.

The Blue Ribbon Report found that regional transportation planning, funding, and implementation need to be better integrated, and that it should be made clear what are regionally significant projects and programs. Destination 2030 builds upon the Blue Ribbon Commission on Transportation recommendations relating to the development of a regionally managed transportation fund.

If motorists face charges to use roadway facilities there should be high-quality transit alternatives available. Motorists must also be able to avoid or reduce the charge they experience by altering when they travel through ride-sharing and route alteration. The Destination 2030 long-term finance and investment goal is to introduce variable roadway pricing where, when, and if it is appropriate.

Possible new funding sources:

- New State Funds - increase motor fuel tax, apply sales tax to the commodity price of fuels, applying a surcharge on transportation goods, a flat charge on passenger vehicles.
- New Regional Funds - authorization to pursue a local option mileage charge, a local option sales tax for transportation purposes, bond financing of transportation investments, and direct infrastructure user fees in the form of value pricing.
- New Local Funding - increase to the local option vehicle license fee, and increased direct funding distributions to local jurisdictions.
- Utilizing Existing Revenue Authority - all transit districts in the central Puget Sound region have unused sales tax authority under current state law.

I-15 HOT Lanes Extension, San Diego

<http://argo.sandag.org/fastrak/>

FasTrak is a website outlining the details of the I-15 express lane system and is user-friendly for the public. Found on this website are links to publications regarding managed lanes value pricing reports, traffic related reports, operations, marketing, and congestion pricing projects to name but a few. A useful link to FAQ's for the public is provided explaining the details of the system.

The I-15 FasTrak three-year demonstration project was originally funded by an \$8 million grant from the Federal Highway Administration (FHWA) under the Congestion Pricing Pilot Program of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. The San Diego region also contributed a \$2 million in-kind match to the federal grant. The Federal Transit Administration (FTA) provided an additional \$230,000 for the project. The project is currently self-supporting, generating approximately \$2.0 million in toll revenue per year. The FasTrak revenue pays for approximately \$750,000 per year in operating costs and \$60,000 for enforcement provided by the California Highway Patrol. State law requires the remaining revenue to be spent improving transit service along the I-15 corridor. The FasTrak project funds the Inland Breeze (Route 980/990) express bus service.

I-15 FasTrak customers are issued an electronic transponder, which affixes to the inside of a vehicle's windshield. As a vehicle approaches the I-15 Express Lanes, roadside electronic signs display the per-trip toll. FasTrak customers who are solo drivers can choose the Express Lanes and pay a toll, or travel on the regular lanes for free. Carpools continue to use the Express Lanes for free. The I-15 Express Lanes are an existing eight-mile, two-lane, reversible high occupancy vehicle (HOV) facility in the median of Interstate 15. Barriers separate the Express Lanes from the regular traffic lanes. Access to the Express Lanes facility is available only at its north and south ends. Carpools and vanpools with two or more occupants, buses, motorcycles are allowed to use the I-15 Express Lanes for free. Authorized FasTrak program participants also may use the Express Lanes for a per-trip toll.



Route 1 HOT Lanes, Santa Cruz

<http://www.sccrtc.org/highway>

In September 2002, the Regional Transportation Commission (RTC) reviewed the feasibility study for a proposed carpool/toll lane on Highway 1. The project adopted by the Commission as part of the Watsonville to Santa Cruz corridor improvements study (MTIS) would have widened Highway 1 to six lanes between Highway 17 and State Park Drive with carpool lanes and High Occupancy Toll (HOT) lanes. HOT lanes can be used by carpools and buses for free, while single occupant vehicle drivers would pay a fee for use of the lane during peak congestion periods. The Commission examined the feasibility of the toll lanes in terms of people moving potential, revenue raising potential, carpool versus single occupancy vehicle use, and additional cost to construct and operate a toll facility. At its meeting, the RTC decided not to pursue HOT lanes, but to instead focus on the High Occupancy Vehicle project that would allow for conversion to a HOT lane at a future date, should demand warrant it.

I-880 HOT Lanes, Alameda County, CA

<http://www.hhh.umn.edu/centers/slp/projects/conpric/index.htm>

A value pricing homepage with links for FAQ's, information kit, an explanation of value pricing, and pricing principles. The homepage establishes links to news and events and established projects such as the Alameda County, I-880 project. This website establishes links to the FHWA's HOT Lanes website.

Interstate 880 is a major congested freeway corridor in Alameda County. It has one contiguous High Occupancy Vehicle (HOV) lane in each direction (plus three mixed-flow lanes in each direction) for approximately 17 miles just south of Oakland to Fremont. This corridor has the highest volume of truck traffic in the region. It connects the Port of Oakland and Oakland International Airport with high technology companies in Santa Clara and southern Alameda counties and with goods distribution centers to the east in San Joaquin County and beyond. The study consisted of determining whether excess capacity does exist, whether there is a market among potential users, and the physical and operational issues associated with such a plan. Both electronic and permit/decal toll collection and enforcement methods were considered. Several lane separation treatments were considered, including buffer separation and unlimited access from mixed-flow lanes into the HOV lanes (the current practice).

I-680 HOT Lanes, Alameda County, CA

<http://www.hhh.umn.edu/centers/slp/projects/conpric/index.htm>

The Alameda County Congestion Management Agency is investigating design concepts and feasibility for providing High Occupancy Toll (HOT) lanes on a 14-mile portion of the I-680 corridor from residential areas to the north and east to the job centers of Silicon Valley. Currently, I-680 is a 6-lane facility with three mixed-flow lanes in each direction; traffic is highly congested and directional southbound in the AM, northbound in the PM. Considerable growth in traffic demand is anticipated. Two additional HOV lanes are planned and funded, with the southbound lane due to open for service in the spring of 2002. The purpose of this study is to review various design concepts for combined HOV/HOT lanes. Major design options under consideration include: one HOV/HOT lane in each direction, two reversible HOV/HOT lanes in the peak direction, and an additional (ninth) lane in the median that would be reversible HOV/HOT. This study will analyze physical, operational, and financial issues associated with these concepts. To date, the study has worked with Caltrans to determine physical design concepts that would permit HOT lane operation in the future.

This unique project would be a first to fully study the potential for implementing the FAIR lanes concept. As with most new road pricing, complementary measures to increase public acceptability need to be deployed. In this case, dynamic or single-trip ridesharing is to be implemented in the study corridor in conjunction with priority parking for ridesharing users at participating Bay Area Rapid Transit (BART) stations. Dynamic ridesharing enables travelers to respond to pricing in flexible ways that traditional ridesharing and transit options do not. It uses web-based and telephone-based systems to allow users to find carpool partners on a "real-time" basis, close to the time that travel is needed. This new type of ridesharing is expected to be more readily acceptable in the Bay Area than elsewhere, because casual carpooling with strangers is already prevalent there, and this project would add some new security features. In addition to cost and time savings (with free use of express lanes), dynamic ridesharing would be further facilitated with reserved premium parking spaces at participating BART stations, on-demand backup services, and in-station electronic information screens providing necessary details about individual ride matches.

The FAIR lanes study will focus on the congested Interstates 580 and 680 in Alameda County and will build upon the existing Interstate 680 value pricing study. The "Sunol Grade" portion of Interstate 680 is, by voter-approved ordinance, required to operate new value-priced carpool lanes, and new carpool lanes are also planned for I-580. The FAIR lanes feasibility study will examine options in this integrated corridor, including HOV/FAIR lane connector ramps at the I-580/I-680 interchange near the Dublin-Pleasanton BART station where the dynamic ridesharing system will first be tested.

I-25 HOT Lanes, Denver, CO

www.valuelanes.com

A website giving information on the I-25 HOT lanes study. Includes an online open house and study questionnaire. The project consists of a two-lane, reversible barrier-separated HOV2+ (2 or more persons) facility from downtown Denver to approximately 70th Avenue. Closed from 10 AM – Noon in order to reverse the facility direction. The website has links to current and archived documents including a two-page flyer on HOT lane application and reports on the Value Express Lanes Feasibility Report documenting the implementation of HOT lanes on I-25.

The reason the study was conducted was because by law the Downtown Express has to operate at a level of service B and it is currently being violated on occasion. The report documents alternatives and financial feasibility of improvements to mitigate this issue. The document concluded that Value Express Lanes are technically feasible on I-25 and US 36 HOV facilities. Value Express lanes are also financially feasible on I-25, and Value Express Lanes are acceptable to members of the public. The report recommended implementing the minimum modification alternative on I-25 which utilizes existing I-25 reversible lanes and pending improvements on US 36, moving an access to improve operations.



Route 167, Seattle, WA

http://67.50.150.182/HOTlanes/HOTlanes_Report_11_6_03.doc

HOT Lanes Pilot Project Analysis is a working draft submitted in November 2003. The Report evaluates the feasibility and potential benefit of converting one or more HOV lanes to a HOT lane. The HOT lane pilot project is on SR 167 between Renton and Auburn. As congestion increases in the general purpose lanes, fees for entering the HOT lane increase. Maximum and minimum opening year toll rates are estimated at \$.60 and \$1.20, respectively, during normal peak period commutes. Toll rates are based on real-time traffic volume. The lower the congestion, the lower the toll. Access to the HOT lane will be controlled by tubular markers and access points between 1,000-1,500 feet in length. Regardless of where vehicles enter and leave the HOT lane, driver will pay at the rate at which they entered the HOT lane for the entire distance of the trip. This is known as a "flat rate dynamic tolling". The areas that will be impacted are the end points of the HOT lanes. Officers will be asked to pull over a vehicle when it does not meet eligibility vehicle occupancy requirements and/or has not paid the necessary toll.

The HOT lane system was modeled with the conversion to HOT lanes and showed improved traffic flow by moving 13% more vehicles through SR 167. Busses and carpools in the HOT lanes will have similar conditions to those they are experiencing now. The preliminary cost of converting the SR 167 HOV lane is between \$12M and \$13M. This cost reflects construction, pavement and signage, toll collection and ITS equipment, design, maintenance, and contingencies. The HOT lanes pilot project results were reported to the Washington State Transportation Commission in November 2003. It will take approximately two years to finalize design, construct, and install.

Twin Cities, MN

[http://knowledge.fhwa.dot.gov/cops/hcx.nsf/All+Documents/1F7C61183ED7C76D85256DC5006B4A75/\\$FILE/Listening_to_the_Public_Final.pdf](http://knowledge.fhwa.dot.gov/cops/hcx.nsf/All+Documents/1F7C61183ED7C76D85256DC5006B4A75/$FILE/Listening_to_the_Public_Final.pdf)

A paper that summarizes public and focus group surveys around the country regarding Value Express Lanes, HOV, roadway pricing, fairness, and revenues. Some example opinions are included below. Other international examples include: Hong Kong, London, and the European Commission's PRIMA project.

California (San Diego & Orange County)

Most commuters approved of HOV lanes and had a favorable impression of the Express Lanes program. Most would pay \$20/month for use of an Express Lane. Support was stronger in the transit rider group than for main line users. Approval among Single Occupancy Vehicle (SOV) riders was greater for selling excess capacity in HOV to SOV's. HOV users were less approving in general citing reasons such as "government will waste the money," and "tolls not fair on roads already paid for." Issues arose regarding the issue of continuous payment when travel is sporadic and changeable. Concern was expressed that fees would benefit the rich and be less beneficial for the poor. Opinions on revenue to improve transit varied from city to city with San Diego and the Bay Area being most favorable.

Portland, OR

Choice was a key factor in people's opinions. People associated value pricing with tollbooths and therefore congestion, giving a negative connotation. People felt that positive incentives should be pursued before value pricing. There was concern over enforcement of value pricing and technology.

Denver, CO

Congestion is a major problem, favorable attitude towards option of avoiding it. Half of those surveyed would pay a fee. Support for Value Express Lanes was marginal.

Minneapolis-St. Paul, MN

Lack of transportation alternatives would not have an effect on driver behavior. Gas tax would be more effective and less costly. Pricing was not perceived as an answer. Low-income people seen as the biggest losers.

It was apparent that the more familiarity the public had with operations and the value pricing concept, the more favorable they became towards it. People are more receptive to paying a fee to bypass congestion on a toll lane than they are to being charged a fee to use a road or bridge. People are more in favor of these projects if it gives them a new travel choice. Public opinion is influenced by the way value pricing is presented or what alternative policy it is compared to. When people feel that value pricing favors the “rich” over the less well off, or if they view it as something they have already paid for, they tend to reject the policy on equity grounds.

MN - Task Force Report

CURBING CONGESTION: Improving traffic flow, transit, and transportation funding through value pricing

<http://www.hhh.umn.edu/centers/slp/projects/conpric/projects/mnreport.pdf>

A task force summary report of meetings held in 2002. The task force believes that while value pricing cannot solve the congestion problem by itself, that it can, when combined appropriately with other policies, help traffic flow more smoothly while helping to improve the environment and make transportation system financing more equitable.

A set of criteria was established, with a primary criteria that the project had to be politically feasible. Other criteria include benefits to public health, safety and environment; positive choices for people; economic benefits; reduced peak period demand mitigating and existing transportation problem; enhance multi-modal transportation; private sector support; public education; and reflect the larger transportation land use vision. The Task Force was concerned primarily about lack of options, and equity, specifically geographic equity. The Crosstown Commons reconstruction project was selected as a potential project because it has a visible, long lasting impact on transportation in the area.

The Task Force defines value pricing as using electronically collected peak-period tolls to manage rush hour traffic flow and provide revenue for transit, highway expansion, and other complimentary policies. Pricing will not solve the problem alone; it requires excess capacity somewhere for trips to divert to; that is, increased investment in highway infrastructure. There need to be alternatives to driving on tolled roads; therefore increased investment in transit is needed. The Task Force recommended that Mn/DOT apply for funding through FHWA Value Pricing program to implement one or more value pricing projects.

Lee County, FL

<http://www.hhh.umn.edu/centers/slp/projects/conpric/projects/project.pdf>

Variable pricing began August 3, 1998 on the Midpoint and Cape Coral toll bridges in Lee County, FL. As of that date, bridge travelers could receive a 50 percent discount on their toll by traveling during specific discount periods if they paid their toll electronically. This toll structure was developed to encourage drivers to leave the peak traffic periods and drive during off peak/discount periods. Significant marketing efforts such as websites, billboards, radio, press releases, and media kits were used to inform the public. Surveys suggest that 38 percent of Cape Coral and Midpoint bridge travelers who used LeeWay had changed their travel patterns to take advantage of flexible pricing. 84 percent had changed their travel time, 9 percent changed route, and 6 percent changed number of trips. Saving money was their primary reason for participating in variable pricing. Inflexible travel time was cited as the main reason for not taking advantage of it.



Managed Lanes Research Websites

Urban Mobility Study

http://gulliver.trb.org/news/blurbs_detail.asp?id=1905

This report detailed a study of 75 urban areas and the impacts of increasing congestion.

FASTLANE: SUMMER 2003

http://gulliver.trb.org/news/blurbs_detail.asp?id=1769

FastLane is a quarterly newsletter that highlights ongoing activities and research on managed lanes in Texas.

NOV TRB NEWS: U.S. CONFERENCE OF MAYORS ENDORSES \$375 BILLION, SIX-YEAR TRANSPORTATION REAUTHORIZATION BILL

http://gulliver.trb.org/news/blurbs_detail.asp?id=2065

Citing the immediate need to fully address the nation's growing congestion, highway safety, and economic problems, leaders of the U.S. Conference of Mayors have endorsed a U.S. House proposal that would invest \$375 billion in highway and transit programs over the next six years.

High Occupancy Vehicles/Toll Lanes

<http://www.path.berkeley.edu/PATH/Intellimotion/intel82.pdf>

State Route 91 in Orange County, California is a value priced express lane. Interstate 15 in San Diego has two reversible HOT lanes and tolls vary due to congestion level. Katy Freeway in Houston, TX is a variation of a HOT lane. Two person vehicles pay a toll, while 3-plus vehicles can travel for free.

Toll Facilities in the United States

<http://www.fhwa.dot.gov/ohim/tollpage.htm>

This site is full of information on financing, types of toll roads, toll facts, and a listing of all toll roads in the US as of January 1, 2003.

Indiana Toll Road Charge Account Information

<http://www.state.in.us/dot/motoristinfo/pdfs/chargeinfo.pdf>

Credible businesses in Indiana with monthly toll charges in excess of \$75 will be able to establish a toll credit account.

Minnesota Announces First HOT Lane Project

<http://www.dot.state.mn.us/information/mnpass/>

The project, known as MnPass, will convert the HOV lanes on I-394 in Minneapolis to High Occupancy Toll (HOT) lanes in order to take advantage of excess capacity.

NOV TRB NEWS - PUBLIC ROADS: SEPTEMBER-OCTOBER 2003 ISSUE NOW ONLINE

http://gulliver.trb.org/news/blurbs_detail.asp?id=2077

The Florida DOT's recently developed SunPass system for electronic toll collection, Florida's new \$517 million Suncoast Parkway resulted from a highly successful partnering process.

Development of a Toll Viability Screening Tool

<http://rip.trb.org/browse/dproject.asp?n=8967>

This project develops a spreadsheet analysis tool to provide a preliminary determination of the viability of a toll road or toll-supported project. The tool uses inputs typically available to Texas Department of Transportation (TxDOT) or local planning agencies and outputs measures representing various aspects of viability including economic measures, such as net present value or benefit: cost ratio.

SATELLITE TECHNOLOGY STUDIED FOR PAN-EUROPEAN ROAD TOLLING SYSTEM

http://gulliver.trb.org/news/blurb_detail.asp?id=1843

This is an evaluation of using satellite technology to implement a pan-European road tolling system.

Improved Quantification of High Occupancy Vehicle (HOV) Lane Delay Savings

<http://rip.trb.org/browse/dproject.asp?n=8972>

This research provides a more realistic estimate of the travel time savings provided by HOV lanes by analyzing delay savings during mainline incident conditions.

UNIVERSITY OF MINNESOTA CTS RESEARCH E-NEWS: NOVEMBER 2003

http://gulliver.trb.org/news/blurb_detail.asp?id=2073

This electronic newsletter includes short articles on driver response to Changeable Message Signs (also known as Variable Message Signs [VMS]).

New Web Site Provides Capacity Building for Planning

<http://tfhrc.gov/trnspr/sep03/index.htm#new>

In July 2003, the Federal Highway Administration (FHWA) launched the "Transportation Planning Capacity Building" web site (www.planning.dot.gov). A clearinghouse for information on transportation planning, the site will help transportation professionals and decision makers save time and money learning about the factors involved in the planning process and finding answers to their planning questions.

TRAFFIC CONGESTION RATED A PROBLEM BY TWO OUT OF FIVE U.S. ADULTS

http://gulliver.trb.org/news/blurb_detail.asp?id=1764

More than two out of five adults in the United States report that traffic congestion is a problem in their communities, according to results from the U.S. Department of Transportation's Bureau of Transportation Statistics Omnibus Household Survey.

OMNIBUS HOUSEHOLD SURVEY SHOWS AMERICANS' AVERAGE COMMUTING TIME IS SLIGHTLY MORE THAN 26 MINUTES

http://gulliver.trb.org/news/blurb_detail.asp?id=1814

The average daily one-way commute to work in the United States takes slightly more than 26 minutes. The survey found that 94 percent of commuters spend 60 minutes or less to get to work.

Northside Drive Reversible Lane Traffic Analysis

<http://www.dot.state.ga.us/dot/operations/traffic-safety-design/downloads/Final%20Report.pdf>

Reversible lanes are a commonly implemented traffic control strategy. Used throughout the US, reversible lanes control traffic on congested arterials and bridges by allocating roadway lanes to one direction or another by time of day. This strategy is particularly effective when traffic volumes are directional in nature and right-of-way is limited.

Manual on Uniform Traffic Control Devices

http://mutcd.fhwa.dot.gov/HTM/2003/part2/fig2b-05_longdesc.htm

Approved MUTCD signing for reversible lanes for local streets.

Reversible Lane Gate Operators

<http://www.thomasregister.com/olc/06273007/reverse5.htm>

Sales brochure on gates for reversible lanes for freeway applications.



I-15 Reversible Lane Control System (I-15 RLCS) System Requirements Specifications

<http://www.dot.ca.gov/dist11/operations/I15RLCS/>

This document defines the system requirements for the Interstate -15 Reversible Lane Control System.

Grant Road Reversible Lane

<http://dot.ci.tucson.az.us/grntrevln/>

PowerPoint showing success, accident data, and results from utilizing reversible lanes on collector type street. Accident data compares with reversible/without reversible statistics.

Turning the flow in Chicago

<http://www.espatl.com/publications/traffic/trafficindex.htm>

The recently reconstructed Kennedy Expressway (Interstate Route 90/94) in Chicago, Illinois, incorporates two isolated reversible median express lanes along a seven-mile portion of the City.

Unilight...Creating a single vision

<http://www.unilights.com/>

Sales website on reversible lane signal controls.

Reversible Lane Change Systems

http://www.bb gates.com/pdf/reversible_lane.pdf

Sales brochure on gates for reversible lanes for freeway applications.

Enforcement Issues on Managed Lanes

<http://managed-lanes.tamu.edu/products/bulletins/4160-11B.pdf>

A managed lane facility requires effective enforcement policies and programs to operate successfully. This document discusses different enforcement options.

I-15 Congestion Pricing Project

<http://argo.sandag.org/fastrak/pdfs/task-1d.pdf>

Discusses whether trucks should be allowed access to the reversible High Occupancy Vehicle (HOV) lanes.

High Occupancy/Toll Lanes: Phasing in Congestion Pricing a Lane at a Time

<http://www.rppi.org/transportation/ps170.html>

A consensus is emerging among transportation economists that the best way to deal with freeway congestion is to charge for driving during peak hours. The main barrier to implementation is political: drastic change is politically unpopular.

Investigating the General Feasibility of High-Occupancy Toll Lanes in Texas

<http://tti.tamu.edu/product/catalog/reports/4915-1.pdf>

The characteristics of both facility and traffic are explored in an attempt to identify those combinations that suggest successful implementation of a HOT lane as well as those factors that will contradict a HOT lane. This report identifies critical issues warranting careful study during preliminary investigations. It discusses other aspects of candidate HOT lanes, such as revenue potential, equity Considerations, design requirements, and operational limitations. HOT Lane comparison SR-91 (Orange County), I-15 (San Diego), I-10 (Houston) including public acceptance statistics.

Barrier Systems, Inc.

<http://www.barriersystemsinc.com/>

This is a sales website for concrete moveable barrier. Creating congestion relief on the move.

91 Express Lanes

[http://www.91expresslanes.com/Homepage for SR-91 HOT lanes in Orange County.](http://www.91expresslanes.com/Homepage%20for%20SR-91%20HOT%20lanes%20in%20Orange%20County)

Cordon Tolls - Florida: Cordon Pricing in Lee County

<http://knowledge.fhwa.dot.gov/cops/hcx.nsf/0/bafeea46293af20385256dc8005e05b2?OpenDocument>

The Town of Fort Myers Beach in Lee County, Florida, is an island community with a heavy influx of visitors during the tourist seasons. Access to the Town is provided by road at two points of entry. Travel within the Town can be challenging, particularly during the winter tourist season. Due to the relatively small land area and environmental issues, options for additional roadways on the island are not practical. Further, due to limited right-of-way on the only non-local road on the island, and the high financial and social costs of obtaining additional right-of-way, significant widening is not considered practical. The Town is studying the feasibility of introducing a new variable toll at both approaches to the Town.

Variable Cordon Pricing for Manhattan?

<http://www.tstc.org/bulletin/20010402/mtr31102.htm>

The advent of time-sensitive tolls on PA's Hudson River crossings could be seen as a first step towards a variable cordon pricing program for Manhattan.

Mobilizing the Region: London Set to Launch Cordon Pricing

<http://www.tstc.org/bulletin/20020916/mtr38307.htm>

London - a city with traffic and congestion problems comparable to New York's - is about to actually do something about it. Beginning in February, motorists who enter an eight square mile area of central London between 7 AM and 6:30 PM will pay a daily fee of £5 (about \$7.80).

Congestion Pricing

<http://yosemite.epa.gov/aa/tcmsitei.nsf/0/647e950797e1f217852565d90073f4e6?OpenDocument>

Congestion pricing is a relatively new transportation control measure (TCM) that is often referred to as "value pricing." This TCM, which is still in the pilot program stage of development in the United States operates in one of two ways.

Cities on the Move

http://www.worldbank.org/transport/utsr/yokohama/day3/kg_fin.pdf

PowerPoint on cordon pricing and financing in Singapore.

